UNIVERSITY of BRADFORD

Library

University of Bradford eThesis

This thesis is hosted in Bradford Scholars – The University of Bradford Open Access repository. Visit the repository for full metadata or to contact the repository team

© University of Bradford. This work is licenced for reuse under a Creative Commons Licence.

Understanding the later prehistoric field systems of the Yorkshire Dales

Hannah Jocelyn BROWN

Submitted for the Degree of Doctor of Philosophy
School of Archaeological Sciences
Faculty of Life Sciences
University of Bradford

2016

Abstract

Hannah Jocelyn Brown

Understanding the later prehistoric field systems of the Yorkshire Dales

Keywords: coaxial, field system, boundary, GIS, late prehistory, landscape archaeology.

The Yorkshire Dales National Park contains some of the UK's most extensive and well-preserved prehistoric landscapes. Of particular interest are a number of coaxial field systems, which cover hundreds of hectares and exhibit significant time-depth, yet remain little studied and poorly understood in relation to comparable resources elsewhere in Britain and north western Europe. This research aims to address this situation, bringing together existing disparate source materials for the first time, alongside supplementary field observation, to develop a detailed record of the coaxial landscapes. Using a Geographic Information System to manage, interpret and interrogate the combined datasets, analysis focuses on form and character, and explores prehistoric use of the iconic landscape. The study seeks to enhance our knowledge and understanding of the landscapes' place in space and time, setting them against the backdrop of systems elsewhere, and attempts to place them within the context of later prehistoric society. The research, conducted in association with the Yorkshire Dales National Park Authority, also informs the management and public understanding of the archaeological resource of the Dales via the Historic Environment Record.

Acknowledgements

First of all, I would like to take the opportunity to ‘officially’ say thank you to my supervisors, Professor Ian Armit and Dr Chris Gaffney at the University of Bradford, Robert White at the Yorkshire Dales National Park Authority and Dr Roger Martlew at the Dales Landscape Research Trust, for their encouragement, help and enthusiasm throughout the PhD. Particular thanks go to my primary supervisor, Ian, for his time and patience. Thank you also to Miles Johnson of the Yorkshire Dales National Park Authority, who provided me with copious amounts of data and answered many questions - and indeed the rest of the Historic Environment/Sustainable Development team who put up with me for six months during my placement.

This project was funded by an Arts and Humanities Research Council Collaborative Doctoral Award.

Many people have gone out of their way to provide me with information and respond to my queries, and I appreciate this greatly. Thanks especially go to Tim Laurie for showing me round Swaledale and answering my questions, and to Gretta Byrne for doing the same at Céide Fields. Thanks also to Matthew Oakey at Historic England for providing National Mapping Project data, and Dave MacLeod for discussions about it. At the University of Bradford JB Priestly Library Special Collections, Alison Cullingford was extremely helpful and allowed me to take the Raistrick Collection back to the Archaeology department to digitize it. And when I say ‘me’… thank you to Victoria Anderton-Johnson who did the scanning. Thanks also to the English Heritage geophysics team for allowing me to gatecrash their survey of possible coaxials in Lancashire.

Thanks to Tom Sparrow for assisting with assorted computer hardware issues, to Dr Helen Goodchild (University of York) for answering my GIS queries, and to Finn Pope-Carter and Chrys Harris for attempting to talk me through Python and, failing that, writing the necessary code. Thanks to Mary K. Saunders for many useful coaxial-related deliberations. Various and assorted office mates have helped me on my way, via much-appreciated discussions and moral support - thank you!

Thank you to Sarah Brown for arranging interviews in Madagascar: also thanks to Sosony for being a willing interviewee and Mbola Randrianantenaina Sylvestre for his translation skills and explanations.

And thanks to Maggie and Bryan Brown for our coaxial-based adventures - you now know far more than you need to about prehistoric field systems.

Table of contents

Abstract i
Acknowledgements ii
Table of Contents iv
List of Figures ix
List of Tables ....

1. Introduction 1
1.1 Field system in the Yorkshire Dales 2
1.2 Terminology 5
1.3 Aims and objectives 8
1.4 The Yorkshire Dales National Park 9
1.4.1 Location 10
1.4.2 Geology and geomorphology 12
1.4.3 Soils and vegetation 15
1.4.4 Current land use 16
1.5 Structure of the thesis 16

2. Previous approaches to the study of field systems in Britain 18
2.1 Previous approaches to field systems 18
2.1.1 Early research 18
2.1.2 The 'Hoskins Effect' 23
2.1.3 Empirical discoveries of the 1970s and 1980s 25
2.1.4 'Form, function and concept' 29
2.1.5 The impact of developer-funded archaeology 32
2.2 Work on prehistoric field systems in the Yorkshire Dales 33
2.3 Geographical Information Systems in archaeology 43
2.4 Summary 45

3. Method 47
3.1 Sources and datasets 48

3.1.1 Extant archaeology 48
3.1.2 YDNPA Historic Environment Record 48
3.1.3 Yorkshire Dales Mapping Project 51
3.1.4 Lidar 53
3.1.5 Topographic data 56
3.1.6 Aerial photography 56
3.1.7 Published and unpublished plans 57
3.2 Method and limitations 60

4. Anatomy of the field systems 63
4.1 The Coaxial Boundaries 65
4.2 Spatial distribution 68
4.3 The systems 77
4.4 The Wharfedale Systems 82
4.4.1 Wharfedale 82
4.4.2 Middlesmoor Pasture 83
4.4.3 Grassington-Kettlewell Group 88
4.4.4 Grassington-Kettlewell System 1 96
4.4.5 Grassington-Kettlewell System 2 101
4.4.6 Grassington-Kettlewell System 3 105
4.4.7 Grassington-Kettlewell System 4 110
4.4.7 Grassington-Kettlewell System 4a 115
4.4.8 Grassington-Kettlewell System 5 120
4.4.9 Grassington-Kettlewell System 6 125
4.4.10 Kilnsey Systems 1 and 2 130
4.5. The Littondale systems 134
4.5.1 Littondale 134
4.5.2 Halton Gill 135
4.5.3 Cowside Beck 140
4.5.4 Arncliffe 144
4.6 The Ribblesdale systems 149
4.6.1 Ribblesdale 149
4.6.2 Horton 150
4.6.3 Stainforth 155

4.6.4 Settle 160
4.7 The Wensleydale systems 164
4.7.1 Wensleydale 164
4.7.2 Carperby 1 166
4.7.3 Carperby 2 171
4.7.3 West Burton 175
4.8 The Swaledale systems 179
4.8.1 Swaledale 179
4.8.2 Low Row Pasture 180
4.8.3 Healaugh 185
4.8.4 Reeth 190
4.8.5 Harkerside 195
4.8.6 Grinton Moor 200

5. Coaxial systems of the Yorkshire Dales: analysis 205
5.1 Size and shape: the boundaries and the bounded 205
5.1.1 The nature of the boundaries 205
5.1.2 Additional (in)visible boundaries 210
5.2 Dates 220
5.2.1 Relative evidence 220
5.2.2 Absolute evidence 222
5.2.3 Post-prehistoric use of fields 224
5.3 System layout 224
5.3.1 Terminal and transverse boundaries 224
5.3.2 System dimensions 228
5.3.3 ‘Density’ of boundaries 231
5.3.4 Frequency of boundaries 235
5.4 Aspect and orientation 240
5.4.1 Aspect 240
5.4.2 Orientation of boundaries 244
5.4.3 Elevation 252
5.5 Settlement and resources 258
5.5.1 Cairns 258
5.5.2 Settlement 267

5.5.3 Civil Parish Boundaries 268
5.5.4 Water supply 269
5.5.5 Insolation 276
5.5.6 Soils 282
5.6 Summary 282

6. The coaxials of the Yorkshire Dales National Park in their wider context 284
6.1 Comparative case studies 284
6.1.1 The Dartmoor reaves 284
6.1.2 The coaxials of the southern/eastern lowlands............ 287
6.1.3 Other comparative examples 289
6.2 The boundaries 290
6.2.1 Stone boundaries: morphology and structure 290
6.2.2 Dates 303
6.2.3 Terminal boundaries & transverse boundaries 306
6.2.4 System dimensions 309
6.2.5 ‘Density’ of boundaries 312
6.2.6 Frequency of boundaries 314
6.2.7 Orientation and aspect 315
6.2.8 Archaeological Context 318
6.2.9 Land use 319
6.3 Conclusion 321

7. Discussion 322
7.1 Use of the landscape 322
7.1.1 Use of natural terrain 323
7.1.2 Orientation and alignment 325
7.2 Less visible aspects 326
7.3 Identity of the boundary builders 333
7.4 Conclusion 338

8. Conclusion 340

Bibliography.. 344

Appendices 360

Appendix 1: Known coaxial field systems in the YDNP……….…....... 360

Appendix 2: Possible coaxial field systems in the YDNP 385

Appendix 3: Frequency of coaxial strip widths ……………............. 395

Appendix 4: Boundary orientation and hillside aspect …................ 406

List of figures

Fig. 1.1 Characteristic Dales landscape 2
Fig. 1.2 Distribution of known prehistoric agricultural features 3
Fig. 1.3 'Celtic' fields above Malham Cove 4
Fig. 1.4 Aerial view of settlement and enclosures at Burton Moor 4
Fig. 1.5 Location of the Yorkshire Dales National Park 9
Fig. 1.6 The topography of the Yorkshire Dales National Park 10
Fig. 1.7 Geological map of the Yorkshire Dales National Park 12
Fig. 1.8 Geological cross section 14

Fig. 2.1 Curwen's 'Celtic' fields of Britain 21
Fig. 2.2 A Dartmoor reave 25
Fig. 2.3 Probing peat at Céide fields 28
Fig. 2.4 Antiquarian exploration of a 'prehistoric enclosure' 33
Fig. 2.5 Places mentioned in the text: Grassington to Kettlewell 35
Fig. 2.6 Curwen's Celtic cultivation areas, High Close Pasture 37
Fig. 2.7 Raistrick's map of prehistoric cultivations 39
Fig. 2.8 Coaxial field systems in Swaledale 41

Fig. 3.1 Distribution of HER records as of December 2013 50
Fig. 3.2 Examples of Yorkshire Dales Mapping Project data 52
Fig. 3.3 Available lidar data for the Yorkshire Dales National Park 54
Fig. 3.4 Sample of 25cm resolution lidar data 55
Fig. 3.5 "Air machine survey" plan annotated by A. Raistrick 58
Fig. 3.6 Field plan by A. Raistrick 59
Fig. 3.7 Flow chart summarizing research processes 60

Fig. 4.1 Distribution of prehistoric sites and finds 64
Fig. 4.2 Axial boundary of the Grassington-Kettlewell 6 coaxial system 65
Fig. 4.3 Boundaries of the Grassington-Kettlewell 6 coaxial system 66
Fig. 4.4 Axial boundary of the Middlesmoor Pasture system 66

Fig. 4.5 Axial boundary on Reeth Low Moor, Swaledale 67
Fig. 4.6 Axial boundary of the Grinton coaxial system 67
Fig. 4.7 Distribution of known coaxial field systems 68
Fig. 4.8 Distribution of possible coaxial field systems 69
Fig. 4.9 View of contrasting topography in Dentdale 71
Fig. 4.10 Coaxial field systems in relation to prehistoric sites and finds 73
Fig. 4.11 Distribution of field boundaries and enclosures 74
Fig. 4.12 Distribution of plough marks and farmsteads 75
Fig. 4.13 Distribution of assorted field system 76
Fig. 4.14. Known coaxial field systems 77
Fig. 4.15 Possible coaxial field systems 78
Fig. 4.16 Known coaxial systems in relation to major catchment areas 79
Fig. 4.17 Upper Wharfedale and Kettlewell 82
Fig. 4.18 Location of Middlesmoor Pasture coaxial system 83
Fig. 4.19 Middlesmoor coaxial boundaries in geographical context 84
Fig. 4.20 Middlesmoor Pasture coaxial system with HER features/finds 85
Fig. 4.21 Middlesmoor Pasture coaxial boundary 86
Fig. 4.22 Location of Grassington-Kettlewell coaxial systems 88
Fig. 4.23 Grassington-Kettlewell coaxial boundaries in context 89
Fig. 4.24 Upper Wharfedale and Kettlewell, looking south 90
Fig. 4.25 Eastern side of Wharfedale 91
Fig. 4.26 Conistone Dibb looking west towards Wharfedale 92
Fig. 4.27 Topography between Conistone Dibb and Grassington 92
Fig. 4.28 Field systems Grassington-Kettlewell 1-6 94
Fig. 4.29 Location of G-K 1 coaxial system 96
Fig. 4.30 G-K 1 coaxial boundaries in geographical context 97
Fig. 4.31 G-K 1 coaxial system with HER features/finds 98
Fig. 4.32 G-K 1 axial boundary 99
Fig. 4.33 Location of G-K 2 coaxial system 101
Fig. 4.34 G-K 2 coaxial boundaries in geographical context 102
Fig. 4.35 G-K 2 coaxial system with HER features/finds 103
Fig. 4.36 Location of G-K 3 coaxial system 105
Fig. 4.37 G-K 3 coaxial boundaries in geographical context 106
Fig. 4.38 G-K 3 coaxial system with HER features/finds 107

Fig. 4.39 G-K 3 axial boundary 108
Fig. 4.40 Location of G-K 4 coaxial system 110
Fig. 4.41 G-K 4 coaxial boundaries in geographical context 111
Fig. 4.42 G-K 4 coaxial system with HER features/finds 112
Fig. 4.43 Aerial view of system G-K 4 113
Fig. 4.44 G-K 4 axial boundaries 113
Fig. 4.45 Building platform within G-K system 4 114
Fig. 4.46 Location of G-K 4a coaxial system 115
Fig. 4.47 G-K 4a coaxial boundaries in geographical context 116
Fig. 4.48 G-K 4a coaxial system with HER features/finds 117
Fig. 4.49 Overview of G-K system 4a 118
Fig. 4.50 Alignment of a G-K 4a system on a barrow 119
Fig. 4.51 Location of G-K 5 coaxial system 120
Fig. 4.52 G-K 5 coaxial boundaries in geographical context 121
Fig. 4.53 G-K 5 coaxial system with HER features/finds 122
Fig. 4.54 View across southern part of G-K system 5 123
Fig. 4.55 Location of G-K 6 coaxial system 125
Fig. 4.56 G-K 6 coaxial boundaries in geographical context 126
Fig. 4.57 G-K 6 coaxial system with HER features/finds 127
Fig. 4.58 Aerial view of G-K system 6 128
Fig. 4.59 Small square fields within G-K system 6 128
Fig. 4.60 Location of Kilnsey 1 and 2 coaxial systems 130
Fig. 4.61 Kilnsey 1 and 2 boundaries in geographical context 131
Fig. 4.62 Kilnsey 1 and 2 systems with HER features/finds 132
Fig. 4.63 Littondale 134
Fig. 4.64 Location of Halton Gill coaxial system 135
Fig. 4.65 Halton Gill coaxial boundaries in geographical context 136
Fig. 4.66 Halton Gill coaxial system with HER features/finds 137
Fig. 4.67 Aerial view of Halton Gill system 138
Fig. 4.68 Location of Cowside Beck coaxial system 140
Fig. 4.69 Cowside Beck coaxial boundaries in geographical context 141
Fig. 4.70 Cowside Beck coaxial system with HER features/finds 142
Fig. 4.71 Location of Arncliffe coaxial system 144
Fig. 4.72 Arncliffe coaxial boundaries in geographical context 145

Fig. 4.73 Arncliffe coaxial system with HER features/finds 146
Fig. 4.74 Aerial view of Arncliffe coaxial system 147
Fig. 4.75 Ribblesdale 149
Fig. 4.76 Location of Horton coaxial system 150
Fig. 4.77 Horton coaxial boundaries in geographical context 151
Fig. 4.78 Horton coaxial system with HER features/finds 152
Fig. 4.79 Horton axial boundary 153
Fig. 4.80 Location of Stainforth coaxial system 155
Fig. 4.81 Stainforth coaxial boundaries in geographical context 156
Fig. 4.82 Stainforth coaxial system with HER features/finds 157
Fig. 4.83 Aerial view of Stainforth coaxial system 158
Fig. 4.84 Location of Settle coaxial system 160
Fig. 4.85 Settle coaxial boundaries in geographical context 161
Fig. 4.86 Settle coaxial system with HER features/finds 162
Fig. 4.87 Settle axial boundaries 163
Fig. 4.88 Wensleydale 164
Fig. 4.89 Location of Carperby 1 coaxial system 166
Fig. 4.90 Carperby 1 coaxial boundaries in geographical context 167
Fig. 4.91 Carperby 1 coaxial system with HER features/finds 168
Fig. 4.92 Carperby 1 axial boundary 169
Fig. 4.93 Location of Carperby 2 coaxial system 171
Fig. 4.94 Carperby 2 coaxial boundaries in geographical context 172
Fig. 4.95 Carperby 2 coaxial system with HER features/finds 173
Fig. 4.96 Location of West Burton coaxial system 175
Fig. 4.97 West Burton coaxial boundaries in geographical context 176
Fig. 4.98 West Burton coaxial system with HER features/finds 177
Fig. 4.99 Swaledale 179
Fig. 4.100 Location of Low Row Pasture coaxial system 180
Fig. 4.101 Low Row Pasture coaxial boundaries in geographical context..181
Fig. 4.102 Low Row Pasture coaxial system with HER features/finds 182
Fig. 4.103 Low Row Pasture axial boundary 183
Fig. 4.104 Location of Healaugh coaxial system 185
Fig. 4.105 Healaugh coaxial boundaries in geographical context 186
Fig. 4.106 Healaugh coaxial system with HER features/finds 187

Fig. 4.107 Aerial view of the Healaugh and Reeth systems 188
Fig. 4.108 Location of Reeth coaxial system 190
Fig. 4.109 Reeth coaxial boundaries in geographical context 191
Fig. 4.110 Reeth coaxial system with HER features/finds 192
Fig. 4.111 Reeth axial boundary 193
Fig. 4.112 Location of Harkerside coaxial system 195
Fig. 4.113 Harkerside coaxial boundaries in geographical context 196
Fig. 4.114 Harkerside coaxial system with HER features/finds 197
Fig. 4.115 Harkerside clearance cairn 198
Fig. 4.116 Location of Grinton Moor coaxial system 200
Fig. 4.117 Grinton Moor coaxial boundaries in geographical context........ 201
Fig. 4.118 Grinton Moor coaxial system with HER features/finds 202
Fig. 4.119 Grinton Moor axial boundary 203

Fig. 5.1 Excavated boundary near Healaugh, Swaledale 206
Fig. 5.2 Traditional Dartmoor boundaries 208
Fig. 5.3 Dry stone walling in a state of disrepair, Wharfedale 209
Fig. 5.4 Herding cattle in southeast Madagascar 210
Fig. 5.5 Land division in southeast Madagascar (1) 211
Fig. 5.6 Land division in southeast Madagascar (2) 212
Fig. 5.7 Grinton Moor gradient plot 214
Fig. 5.8 West Burton gradient and profile plots 215
Fig. 5.9 View across West Burton system 215
Fig. 5.10 View of Dove Scar 216
Fig. 5.11 Cowside Beck gradient and profile plots 217
Fig. 5.12 Middlesmoor Pasture profile plot 218
Fig. 5.13 View of natural terraces, Middlesmoor Pasture 218
Fig. 5.14 G-K 2 gradient plot 219
Fig. 5.15 Crossing point of boundaries in G-K system 6 222
Fig. 5.16 Lidar image of Maiden Castle, Swaledale 227
Fig. 5.17 Kilnsey 2 coaxial system, use of limestone scar 228
Fig. 5.18 Area of individual systems 230
Fig. 5.19 Length of boundaries in individual systems 231
Fig. 5.20 Relationship between boundary length and area 232

Fig. 5.21 Density of boundaries compared with system area 233
Fig. 5.22 Density of boundaries viewed by dale 234
Fig. 5.23 Comparison of distances between boundaries 235
Fig. 5.24 Median distances between boundaries 238
Fig. 5.25 Variation of median distances between boundaries 239
Fig. 5.26 Aspect analysis across the National Park 241
Fig. 5.27 Local aspect variation 242
Fig. 5.28 Predominant aspect of land used for coaxial systems 243
Fig. 5.29 Ray diagram: boundary orientation for West Burton system 246
Fig. 5.30 Ray diagram: boundary orientation for Halton Gill system 247
Fig. 5.31 Ray diagram: boundary orientation for G-K2 system 248
Fig. 5.32 Ray diagram: boundary orientation for G-K 6 system 249
Fig. 5.33 Ray diagram: boundary orientation for Harkerside system 250
Fig. 5.34 Combined ray diagram for all coaxial systems 252
Fig. 5.35 Elevation of coaxial systems relative to valley topography 253
Fig. 5.36 Distribution of coaxial systems in the middle of valley sides 254
Fig. 5.37 'View' of coaxial boundaries on valley sides 255
Fig. 5.38 View northwest from Middlesmoor Pasture system 256
Fig. 5.39 View southwest from West Burton system 256
Fig. 5.40 View northwest from Arncliffe system 257
Fig 5.41 View southwest from Reeth system 257
Fig. 5.42 Distribution of possible/known prehistoric cairns in the YDNP.... 258
Fig. 5.43 Prehistoric burial cairns near Grassington (north) 261
Fig. 5.44 Prehistoric burial cairns near Grassington (south) 262
Fig. 5.45 Burial cairn MYD4025 with adjacent boundaries 264
Fig. 5.46 Conspicuous boundary above Grassington 265
Fig. 5.47 Possible clearance cairn within the Horton coaxial system 266
Fig. 5.48 Prehistoric settlement evidence in the YDNP 267
Fig. 5.49 Coaxial field systems and current civil parish boundaries 269
Fig. 5.50 Distribution of water sources in Wharfedale 272
Fig. 5.51 Distribution of water sources in Littondale 273
Fig. 5.52 Distribution of water sources in Swaledale 274
Fig. 5.53 Known coaxial systems in relation to rainfall data 275
Fig. 5.54 Known / possible coaxial systems in relation to rainfall data....... 276

Fig. 5.55 Topography causing shadow in Wharfedale 277
Fig. 5.56 Incident solar radiation across the YDNP (summer) 278
Fig. 5.57 Incident solar radiation across Wharfedale (summer) 279
Fig. 5.58 Incident solar radiation across the YDNP (winter) 280
Fig. 5.59 Incident solar radiation across the Wharfedale (winter) 281

Fig. 6.1 Reave on Shovel Down, Dartmoor 285
Fig. 6.2 Fleming's map of the main Dartmoor reave systems 286
Fig. 6.3 Prehistoric settlement evidence, Dartmoor 287
Fig. 6.4 2nd and 1st millennia landscape at Perry Oaks 289
Fig. 6.5 Map of field systems at Céide Fields 290
Fig. 6.6 Comparison of boundary structures 292
Fig. 6.7 Field boundary at Céide Fields 294
Fig. 6.8 Lidar hillshade plots of Carperby and Middlesmoor 296
Fig. 6.9 Aerial view of boundaries on the eastern side of Wharfedale 297
Fig. 6.10 Lidar hillshade plots of boundaries at Stainforth 298
F ig. 6.11 Lidar hillshade plots of boundaries of the G-K 6 system 299
Fig. 6.12 Lidar hillshade plots of boundaries at Harkerside 299
Fig. 6.13 Boundary construction at Shaugh Moor, Dartmoor 301
Fig. 6.14 Boundary realignment at Edenthorpe, South Yorkshire 303
Fig. 6.15 Views of the Dartmeet system, Dartmoor 308
Fig. 6.16 Area of coaxial systems in the YDNP and Dartmoor 309
Fig. 6.17 Density of coaxial systems in the YDNP and Dartmoor 312
Fig. 6.18 Field systems on Salisbury Plain 313
Fig. 6.19 Comparison of boundary orientations 315
Fig. 6.20 Medieval boundaries at Kettlewell, Wharfedale 318

Fig. 7.1 Suggested land use cycle 335
Fig. 7.2 Relationship of coaxial systems to extraction industries …....…. 337

List of Tables

Table 4.1 Dimensions of known coaxial field systems in the YDNP 80

Table 5.1 Transverse and terminal boundaries in YDNP coaxial systems. 225

Table 5.2 Aspect and modal boundary orientation of YDNP systems 244

Table 5.3 Summary of HER information relating to burial cairns 259

1. Introduction

The Yorkshire Dales are criss-crossed by networks of stone walls. Many of these walls date from the eighteenth and nineteenth centuries, when enclosure acts divided up the common land. Some surround medieval plots, having been reused and repaired for centuries. Others are hardly visible in places, low and overgrown by moss and heather, yet still obviously purposeful and direct: probably dating from the late prehistoric period, it is these coaxial field systems that concern this research. The exceptional preservation of the upland landscapes of the Yorkshire Dales offers an excellent opportunity to investigate the field systems in context, in combination with existing archaeological and cartographic resources, in order to better understand their ancient spatial and temporal development and explore their social meaning.

Despite being recognised over a century ago (Speight 1892), the study of landscape elements such as field systems in the Dales has been sporadic since: in the second edition of his book on the well-known later prehistoric reave systems of Dartmoor, Fleming added a chapter to his original 1988 text discussing and describing field systems that had been the subject of work across Britain - despite being comparable to the Dartmoor systems in terms of landscape scale and preservation, the systems of Upper Wharfedale were acknowledged in three lines (Fleming 2008: 145). Collaboration between the University of Bradford, the Yorkshire Dales National Park Authority (YDNPA) and the Yorkshire Dales Landscape Research Trust (YDLRT) has now enabled the required combination of data and resources to serve as a starting point towards the creation of an up-to-date regional understanding. The research presented here is the first of two Collaborative Doctoral Projects and offers a broad, macro-scale approach, to which the second project will add a complementary micro-scale study based on field work, in order to deepen our currently limited grasp of the coaxial field systems of an under-studied region.

In addition to directly adding to our understanding, the gleaning of new knowledge relating to the field systems of the Dales will also feed back into the management of the archaeological remains through better-informed treatment of the cultural resource. This will result from work conducted as part of the placement element of this Collaborative Doctoral Project as well as the addition of conclusions and prepared GIS datasets to the HER database.

1.1 Field systems in the Yorkshire Dales

Fig. 1.1 Characteristic Dales landscape looking northwest up Littondale. This view shows remnants of prehistoric coaxial field systems on the upper dale-sides juxtaposed with Romano-British settlement on the lower slopes and medieval/post-medieval cultivation and systems with their field barns on the valley floor. This close proximity of archaeological remains of differing ages is typical of the Dales. Photo: YDNPA ANY281-5

Almost 40% of the Historic Environment Record (HER) entries detailing prehistoric sites in the Yorkshire Dales National Park refer to agricultural features (fig. 1.2). Ranging from field systems of various types to the more

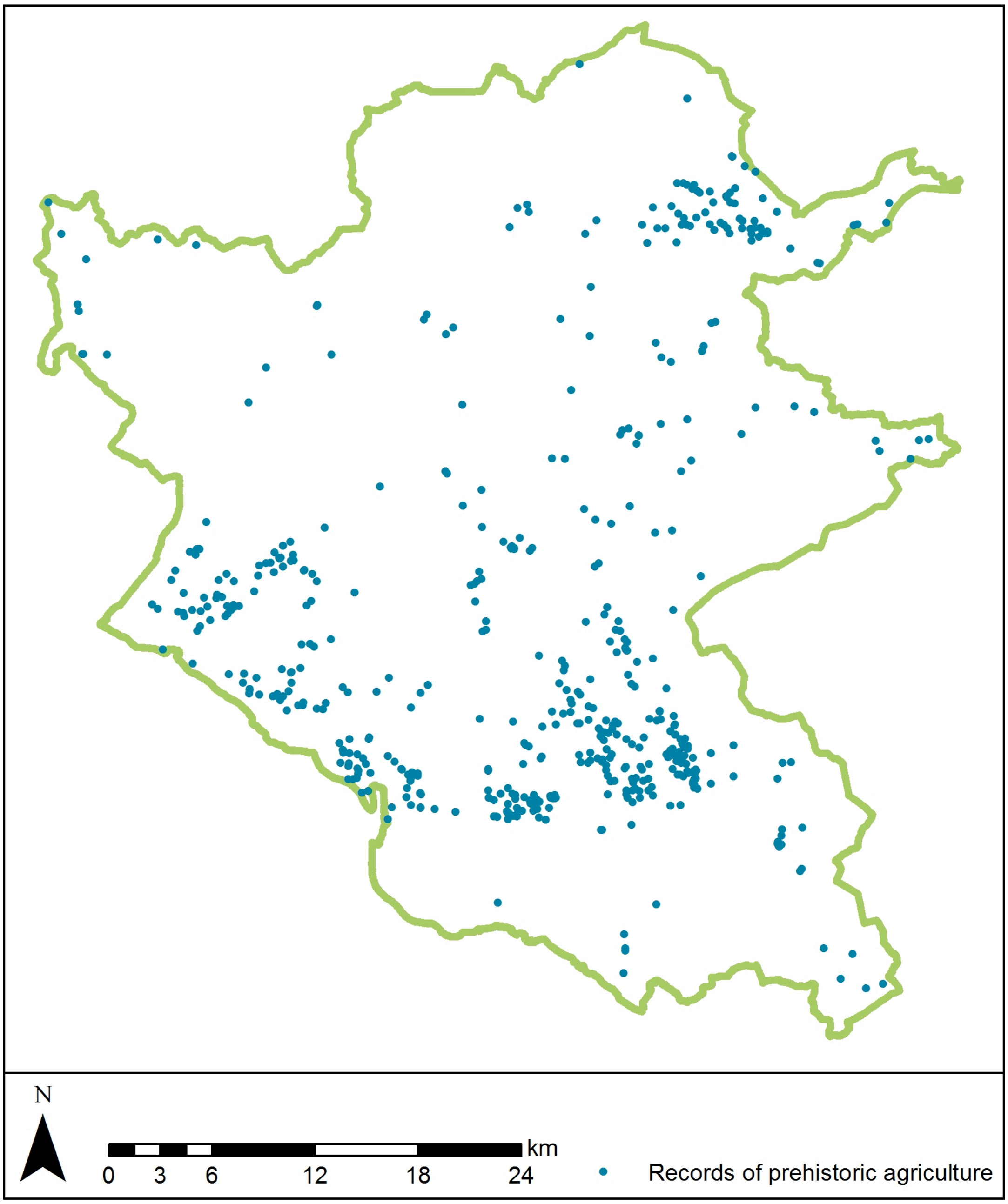


Fig. 1.2 Distribution of known prehistoric agricultural features within the Yorkshire Dales National Park.

loosely defined 'field boundaries', 'farmsteads' and 'enclosures', these features provided alternative solutions to land division, at least some of which will have existed alongside the coaxial field boundaries. Among the recorded field systems are so-called 'Celtic' fields. One of the most accessible examples of these is that located above Malham Cove, where it forms part of a complex multi-period landscape of field systems that range from the prehistoric to the post-medieval (fig. 1.3). Approaching along the

Fig. 1.3 'Celtic' fields above Malham Cove. Photo: author.

Fig. 1.4 Aerial view of settlement and enclosures at Burton Moor, Wensleydale. Photo: YDNPA ANY281-6.

foot path from the west, what first appears as an area of scattered boulders resolves into a series of boundaries of small rectangular fields, possibly used for growing crops or containing animals. Numerous less regular field systems are distributed across the area, one of the best preserved and well-known of which is at Burton Moor on the southern side of Wensleydale, where a complex of sub-circular and irregular enclosures, each around 40-50m in diameter, and the remains of at least 15 buildings are clearly visible from aerial photographs (fig. 1.4). While this provides an unusually comprehensive example, similar, if considerably less extensive, forms are found across the Dales. In particular, settlement remains in the shelter of the limestone scars of the southern Dales are often accompanied by evidence for small plots. Possibly more *ad hoc* and certainly less visible to the modern eye, less familiar agricultural systems are reflected in cairn fields. Perhaps some of the least well understood field systems in the Dales are those categorised as 'coaxial' and it is on these systems that this research will focus.

1.2 Terminology

While archaeological remains are often categorized by their morphology, chronological appearance or composition, such divisions are arguably not entirely satisfactory when applied to the prehistoric field, largely due to our as-yet limited understanding of the genre. It may be that field types are not distinct 'types' but belong on a spectrum incorporating both highly formalized layouts and individual *ad hoc* garden enclosures. In any case, categorization becomes hazy as lengthy coaxial enclosures could be subdivided by less archaeologically visible means, such as hedges or light fences, while aggregated fields often also involve a demonstrable dominant axis; further questions of categorization by form arise when it is considered that the percentage of any given system in use at any one time is unknown, as is the lifespan and degree of reuse of a system. While functional, categories such as those used by the HER do little to accommodate the nuances of diverse field systems that demonstrate great chronological depth. A thesaurus of terms is therefore inevitably somewhat artificial as there can be considerable overlap in the anatomy of the field boundary remains. Recent work on field systems both in the UK and northwest Europe has demonstrated their diversity as well as their common features (Vanzetti *et al*. 2015).

In 1987 Fleming wrote about a group of fields, recurrent over time and space, that were “similar enough morphologically to be worth treating as a taxonomic group” (Fleming 1987: 188). Arguing that these fields were a more homogenous group than ‘hill forts’, ‘megalithic tombs’ or ‘henge monuments’, he thus coined the phrase “coaxial field systems”. Describing these systems as having “one prevailing axis of orientation” (Fleming 1987: 314), Fleming’s definition consciously superseded Bradley’s use of the term ‘cohesive’, which had been used to describe regular arrangements of fields laid out in an ordered manner (Bradley 1978). Fleming considered that the characteristics of coaxial fields included an area greater than 100 hectares and a ‘terrain oblivious’ nature, but that they might vary in date and detail according to locality, the classic example being the reave systems of Dartmoor. Boundaries are either axial or transverse, but the dominance of the main axis is discernible, thereby distinguishing them from ‘Celtic’ fields that frequently form a regular grid-like pattern. In using the term ‘coaxial’ Fleming did not completely replace like with like as Fleming’s idea that the reaves were laid out in one phase - so important to his definition - changed the emphasis from Bradley’s regular versus piecemeal layouts. In doing so, Fleming introduced an element of time, which, in view of the lack of definitive evidence, has yet to be clarified. His interpretation that they were constructed as a synchronous event does not deny the possibility that they can be ordered and regular despite being accumulated over time according to need, but does go some way to explaining the overlapping of terms involved. The term ‘coaxial’ has become a little muddied by its application in different ways in differing situations, for instance in the use of the same term for the field systems of the chalk uplands of southern England and those on Dartmoor despite morphological differences, or its use on occasions as a hierarchical sub-category of ‘Celtic’ fields, for example by McOmish *et al.* (2002: 53) or English, who describes the presence of “blocks of ‘Celtic’ fields, mainly of the coaxial type” on Fyfield and Overton Downs (English 2013: 23). While the technical principle of coaxiality can apply to systems of very different character in practice, the phenomenon of coaxial field systems is not one that is constricted to a narrow time window or geographical area. In the Yorkshire Dales, the fields labelled as coaxial are taken to mean systems of parallel boundaries running across the landscape that demonstrate a dominant axis, although they are also treated as whole, dynamic systems rather than collections of individual morphologically similar features, hence the inclusion, where identifiable, of settlement remains, droveways or additional enclosures, for example.

1.3 Aims and objectives

Focussing on coaxial field systems, this research aims to examine, synthesize and analyse the existing evidence, in order to place the agricultural features in the context of their evolving physical and cultural landscapes.

In order to achieve these aims, the project has the following objectives:

1. Acquisition and assessment of the available cartographic, photographic, documentary and archaeological evidence relating to coaxial field systems in the Yorkshire Dales National Park.

2. Synthesis of the available data via a Geographical Information System as a means to:

   i. store, retrieve, visualize and interrogate the integrated datasets in order to increase knowledge and understanding of the landscapes.

   ii. provide a tangible and accessible end ‘product’ that can be incorporated into the Historic Environment Record of the National Park and therefore contribute to both the management of the Yorkshire Dales resources and the public understanding and use of the local heritage and landscape.

3. Analysis and interpretation of the GIS, paying particular attention to spatial and temporal distribution and possible social, political and economic implications in relation to natural and cultural aspects of the landscape.

4. Intra- and inter-regional comparison of the coaxial systems of the Yorkshire Dales, in order to place them in the context of apparently similar systems across Britain and northwestern Europe.

1.4 The Yorkshire Dales National Park

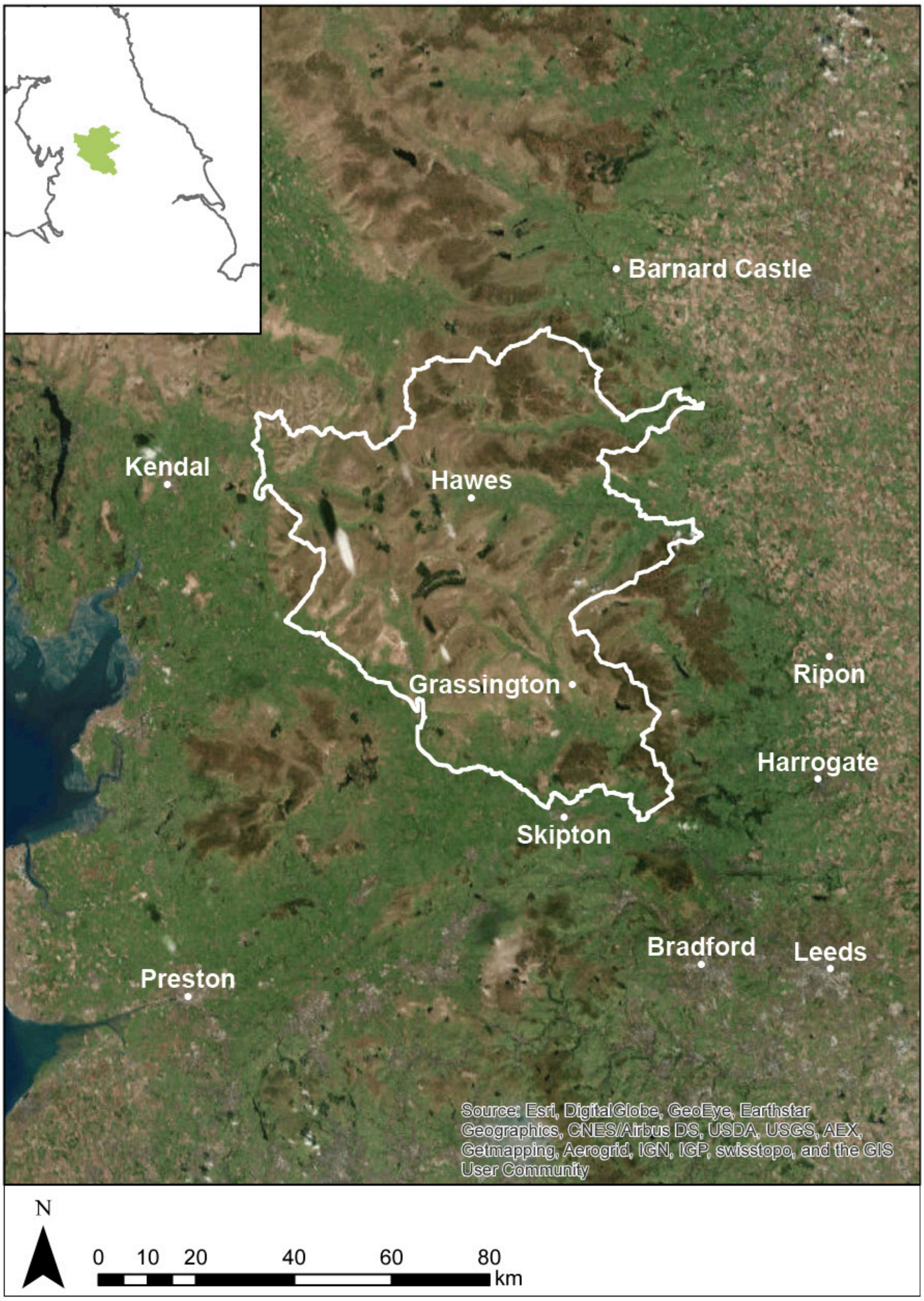


Fig. 1.5 Location of the Yorkshire Dales National Park in northern England.

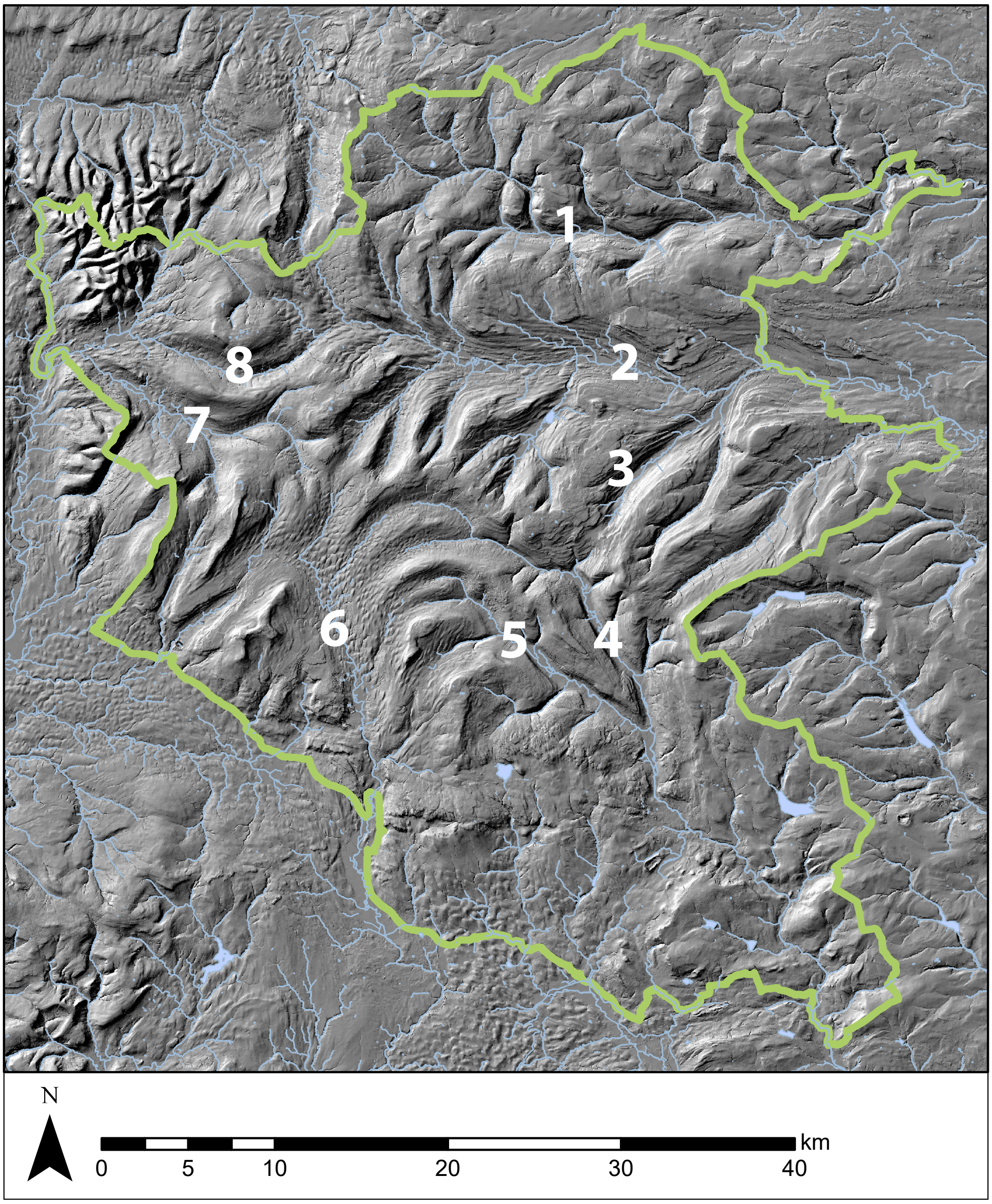


Fig. 1.6 The topography of the Yorkshire Dales National Park showing major dales. 1: Swaledale, 2: Wenseydale, 3: Bishopdale, 4: Wharfedale, 5: Littondale, 6: Ribblesdale, 7: Dentdale, 8: Garsdale. The green line marks the National Park boundary.

1.4.1 Location

The Yorkshire Dales National Park (figs. 1.5 and 1.6) is an area of upland spanning some 176 000ha, comprising extensive tracts of open moorland scored through by the distinctive deep valleys that give the area its name. The Dales landscape is very evidently a product of the combined, and continuing, energetic actions of geology, ice/water, humans and time. While the interconnected geology, soils, vegetation and climate of any area will inevitably have an impact on human occupation, land-use and the resultant archaeology, it can be argued that this relationship is particularly deeply ingrained in this region. Not only has it influenced settlement and activity patterns throughout the period of human occupation of the Dales, but the physical geography continues to influence the visibility of this occupation and, therefore, the derived archaeological interpretations. While such aspects of the physical environment are demonstrably complex in the Dales and incorporate significant local variations, given their dominance in the study area it is worth establishing some of the most important elements not only as a context in which to place the investigation, but as a foundation on which the archaeology needs to be considered.

Part of the Pennine chain, the Yorkshire Dales are located to the north of the Aire and south of the Stainmoore Gaps. The area is situated predominantly on the east of the Pennine watershed, where the major rivers - the Swale, Ure, and Wharfe - drain into the Ouse basin, while those of the western dales contribute to the Ribble and Lune catchments. Elevation ranges from the low ground of the valley floors at around 40m aOD, to the summits of the moorland peaks, with that of Whernside marking the highest point at 736m aOD. The towns of Skipton, Harrogate, Ripon, Barnard Castle and Kendal lie roughly around the perimeter of the Dales, but there are no settlements with populations over 3000 within the Dales themselves (YDNPA 2012: 6). The primary access routes follow the paths of least resistance, running along the floors and lower sides of the major dales, with the inter-dale communication facilitated via smaller and steeper passes.

The Yorkshire Dales National Park was created in 1954 with the intention of managing and protecting the landscapes, wildlife habitat and cultural habitat therein (an additional 41 800ha have been annexed to the Park from August 2016 as the outcome of a Variation Order (Natural England 2012), although data was not available in time to include in this study). Recognition of the importance of the Dales landscapes and habitats has made them the subject of statutory and non-statutory designations at various levels from local to international (YDNPA 2015: 3). There are currently 199 scheduled ancient monuments within the National Park (of which one is a coaxial field system) and 1809 listed buildings (YDNPA 2015: 3).

1.4.2 Geology and geomorphology

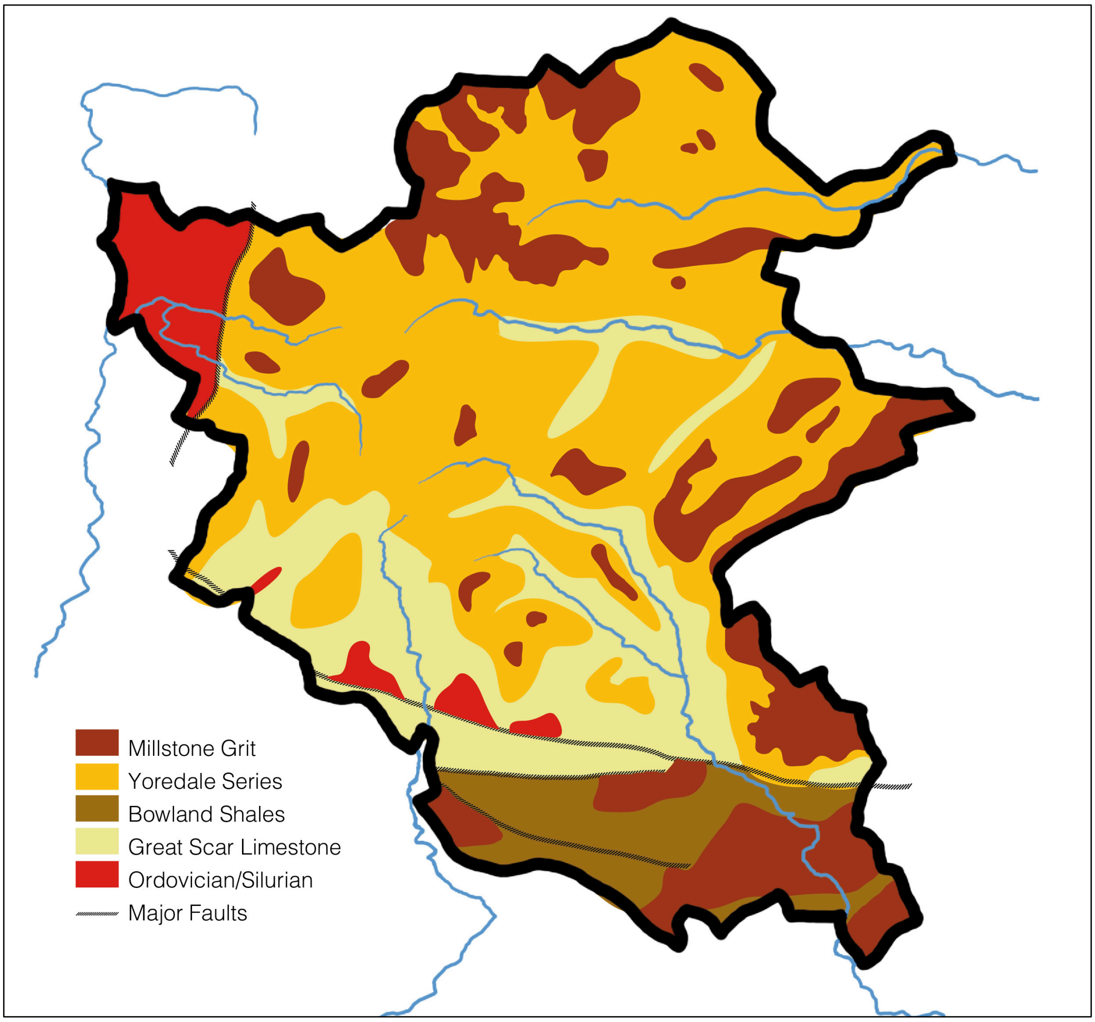


Fig. 1.7 Simplified geological sketch map of the Yorkshire Dales National Park

The identity of the Yorkshire Dales as a discrete landscape has its origins in the underlying geology of the area (fig. 1.7), and stems from pre-Carboniferous tectonic tensions and the weaknesses and faults they created; these divided the basement rocks of the north of England into ‘blocks’ that subsequently rose or subsided independently. The boundaries of the Askrigg Block are manifest on the surface landscape in the coincident transitions of the upland Dales plateau into the more gently rolling topographies of the geologies that surround it. Coring has revealed the presence of Wensleydale Granite underpinning the central dales, which is likely to be responsible for the comparative buoyancy of the Askrigg Block of rocks, and therefore the conditions in which subsequent sediments were laid down (Waltham 2007:18).

The Craven area is dominated by beds of Great Scar Limestone, most famously visible in the scars, pavements and coves that dominate the landscape between Kingsdale and Wharfedale. More recent tectonic pressures have tilted the Askrigg Block, with the consequence that while the Great Scar limestone predominates in the southern Dales, its most northerly occurrence at the surface is as small outcrops in Wensleydale. Cyclically deposited limestones, shales, sandstones and gritstones reflect the variation of sediment size during sequential marine and deltaic deposition phases, and form the Yoredale Series of rocks. The differential rate at which erosion affects the various horizontal bedding planes within the Series and the Great Scar limestone has resulted in distinctive terraced valley sides, most typically seen in Wharfedale and Wensleydale. Thin coal measures reflect periodic swamp conditions during the Carboniferous period, however these are considerably less productive than the Pennine Coal Measures to the south and northeast. The Yoredales are overlain by millstone grit deposits, also formed from deltaic sediment, which predominate at the surface across the northern and eastern Dales, forming the high moorland between the valleys that is so often described as ‘bleak’. The same deposits are also visible where they cap the higher fells, including the iconic peaks of the Craven Dales such as Ingleborough and Pen-y-ghent. A significant deposit of Grassington Grit spreads to the southeast between Wharfedale and Nidderdale.

Also of note is the presence of numerous mineral veins running through parts of the Dales. No viable deposits are known to remain, but galena, zinc/calamine, barite and fluorite of variable qualities have all been extracted at various times in the past and on various scales; lead mining was the most extensively practiced and the surface impact of the industry remains prominent across Swaledale, Arkengarthdale and Grassington Moor.

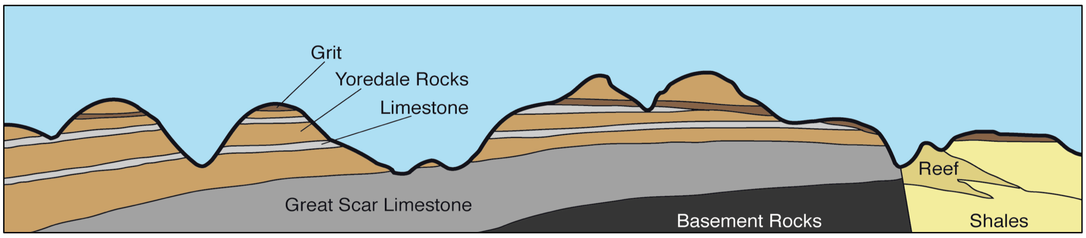


Fig. 1.8 Diagrammatic cross section through the eastern Yorkshire Dales indicating the stratigraphic relationships of the underlying geology. (Exaggerated vertical scale.) (After Waltham 2007: 55.)

The surviving sedimentary geology thus provides the raw stratigraphy that has been eroded, primarily by water and ice, into the modern landscape. The dramatic impact of glacial and glacio-fluvial forces are responsible for both large scale geomorphology and numerous localized landscape features. Glacial scouring is clearly evidenced in the classic U-shaped profiles of the major dales, particularly the southern Dales, which have been cut through the collapse-resistant Great Scar Limestone and have consequently retained their steep valley sides and associated influences on human land use. On a smaller scale, the landscape of the Yorkshire Dales is peppered with remnant examples of glacial activity that include, for example, drumlins (as at Ribblehead) and moraines (the topographic advantage of which is clearly demonstrated by the Roman fort at Bainbridge, Wensleydale), in addition to less structured deposits of till and erratics. Melt-water lakes (including those at Grinton and Kilnsey) are apparent from the remaining silt deposits. Similarly, alluvial fans are visible in places (such as Buckden) where melt-water, having enlarged side valleys, dropped suspended sediment on joining the main dale.

The constant shaping of the Dales by liquid water is also clearly evident: the extensive areas of exposed limestones have been subjected to continuous dissolution by rainwater in combination with carbon dioxide, resulting in the iconic karstic landscape of the southern Dales, which demonstrates all the textbook features of limestone geomorphology. These include extensive pothole systems; it is notable that evidence of human activity in caves from the Neolithic period onwards has been found in the Dales (Taylor 2011). Besides the well-known dramatic features, the most striking aspect of the map is the frequency with which sinkholes of varying dimensions are recorded across the area.

1.4.3 Soils and vegetation

The significance of the underlying geology is also seen in its role as the parent substrate for formation (or otherwise) of overlying soils, and as the basis of drainage conditions, which are among the major influences on vegetation distribution and land use. Given that limestone weathers primarily through dissolution, soils in these areas are usually thin, base and nutrient-poor, with limestone pavements demonstrating the extreme case. Calcareous grassland predominates in both upland and lowland limestone areas, facilitating grazing on a diverse range of grasses and lime-loving wildflowers. The properties of limestone are such that it is free draining, making accumulations of surface water - such as Malham Tarn - rare, although important to prehistoric inhabitants (Donahue 2002). By contrast, the weathering of soft bands of shale within the millstone grit beds to form heavy clay soils, combined with the impeded drainage of the grit and sandstones, results in large tracts of acidic upland grassland, blanket bog and raised bog, and peat accumulation.

Within the dales themselves, the rivers are striking features. Much of the land of the flood plain and valley sides can be characterized as improved grassland, and traditional hay meadows form another iconic element of the landscape. Relatively little land in the Dales is now wooded; it is assumed that valleys were more densely covered, with a high tree-line, prior to deforestation by early settlers, although only limited pollen evidence exists for the area due to a combination of a lack of research and a geology that does not lend itself to long pollen cores (see O'Connor 2011; Rushworth 2010). Pollen samples from both Malham Tarn Moss (Pigott & Pigott 1963) and Raydale (Chiverell *et al*. 2008) have suggested appreciable deciduous cover with intermittent clearance events in the Mesolithic and Bronze Age respectively. Woodland in the Dales has been described as “persistent, if patchy” in its survival throughout prehistory (O’Connor 2011: 8), with radiocarbon-dated bones of lynx and brown bear, both species with large woodland territories, indicating their survival as late as the Early Medieval period (Hetherington *et al*. 2005; Lord *et al*. 2007). As is to be expected in a region with such physical variation, the Yorkshire Dales are prone to localized variation of the prevailing climatic conditions. The range of elevation, for example, is sufficient to effect the dominant vegetation. The stronger wind and frequent low cloud of the exposed high ground offers a strong contrast to the sheltered dales.

1.4.4 Current land use

The modern Dales landscape is overwhelmingly one of pastoral farming - with a preponderance of sheep and some cattle - which contributes to the distinctive landscape of enclosure within the valleys, giving way to fell tops that are considerably more open. Field boundaries are traditionally dry stone, characteristically running up the valley sides at right angles to the contour. Small areas of arable land occur in alluvial valley bottoms, primarily in Wensleydale, although many valleys are prone to flooding, given the poor drainage of glacially deposited boulder clay in conjunction with rapidly rising rivers. Tourism also plays a major role in directly and indirectly influencing land use in the Dales. In addition to the impact of substantial areas of land being maintained to enable outdoor activities - including walking, caving and grouse shooting - the National Park is managed with a heavy emphasis on ‘experiential qualities’ such as tranquility, and a bias towards maintaining and strengthening its ‘sense of place’ (YDNPA 2013: 16).

1.5 Structure of the thesis

This research locates and evaluates the disparate sources relating to the coaxial field systems of the Yorkshire Dales, combining them in order to explore and analyse the coaxial landscapes and the social forces that contributed to them. In doing so, this thesis opens with a review (Chapter two) of existing literature relevant to the archaeological study of coaxial field systems, in order to provide context against which to place this research. Chapter three provides an outline of the approach taken, examines the nature and value of the data sources that have been unearthed, and describes how each was handled to include it in the GIS environment. Having combined the datasets in the GIS environment and used this to map and measure the archaeological features, Chapter four presents the findings. The outcomes are analysed in greater depth in Chapter five, and in comparison to other known coaxial systems in Chapter six. The discussion (Chapter 7) addresses issues that have been raised by the analysis, particularly with regard to the social meaning of the coaxial boundaries.

2. Previous approaches to the study of field systems in Britain

Three aspects of investigation can be identified that colour the last century or so of research into prehistoric field systems, and have structured the transition from the early recognition of field boundaries to the current - far from complete – understanding. The first of these is, inevitably, the development of technological and methodological capabilities; if the majority of advances have not been directly developed for archaeology, they have nevertheless been effectively applied by it. Secondly, the twentieth and twenty-first centuries have seen an on-going inclination towards empirical field data collection, albeit with varying persistence of pace, of which the most immediately noticeable result has been a gradual progression of the recorded distributions of prehistoric field systems across the map of Britain and north-western Europe; while a large percentage of these studies have been local and descriptive in nature, by no means all of them represent the collection of data for its own sake, and what would now be referred to as 'rescue' archaeology has played a motivating role through the second half of the twentieth century. Thirdly, the study of prehistoric agriculture has been influenced by broader currents and agendas in archaeology and the interpretation of prehistoric society; the study of 'field systems' as *systems* in addition to *fields*, for instance, is a comparatively recent approach.

2.1 Previous approaches to field systems

2.1.1 Early research

Interest in the study, in any meaningful way, of prehistoric field boundaries in Britain first emerged in the late nineteenth and first third of the twentieth century with the work of the Dartmoor Exploration Committee (Baring Gould 1900) and the publication of papers by such antiquarians and archaeologists as Blaker (1902), Toms (1911), O.G.S. Crawford (Crawford 1923; Crawford & Keiller 1928) and E. & E.C. Curwen (1923; 1927; 1932), whose observations were primarily focussed on the southern counties of England (although see Curwen 1928 and Raistrick & Chapman 1929). This work approached field boundaries from an agricultural perspective, in contrast to the interest in prehistoric earthwork boundaries *per se*, which was demonstrated around this time by the work of Mortimer, among others (Giles 2006). Emphasis was initially placed on the ‘Celtic’ field systems, consisting of irregular, aggregate groups of small, rectangular fields, which E.C. Curwen described as such to distinguish them morphologically from later ‘Saxon’ field systems (Curwen 1932: 392), and Crawford explicitly linked to “the influx of a new race” (Crawford 1923: 349).

It is worth bearing in mind that these studies stand against the backdrop of national political unrest, social tensions and international conflict of an unprecedented scale. As paralleled in contemporary artistic and literary movements, they appear to be driven by a preoccupation with visions of an idealized, stable and ‘wholesome’ society that lacked the anonymizing and dehumanizing impacts of industrialization and war. Although subtle, this ‘glorification’ comes through in the writing of, for example, E.C. Curwen, who wrote of the forgotten past of “*our* earliest agriculturalists” (Curwen 1927: 285; my italics), explaining that,

> The importance of the part played by agriculture in the economic history of our country is sometimes apt to be forgotten, for its place has, during the past hundred years, been largely taken by manufacture. Down to the beginning of the nineteenth century the bulk of the population still made a living by tilling the fields, just as their fathers had done from time immemorial. It becomes, therefore, a matter of great interest to trace the beginnings and growth of agriculture in our country before the dawn of history (Curwen 1927: 261).

Wickstead (2008a) has drawn attention to a more indirect, though related, emphasis of these early studies on the implied continuity of occupation of the fields and thus the ‘ancient roots’ of the English/British, as opposed to the later influence of the Germanic Saxons. Although nostalgic ideas of agrarian societies were most overtly glorified in interwar Germany, they were widespread across Europe by the end of the nineteenth century - as was the use of archaeology - to provide 'authenticity' to peoples and nations. Indeed, Wickstead has shown how emphasis on the 'Celtic' and 'Saxon' roots of the English field system fluctuated in accordance with trends of international relations (Wickstead 2008a).

Despite invoking nostalgic agrarian traditions, these early studies were often underpinned by modern techniques and survey approaches, which have continued to play a central role in the detection and analysis of field systems since. Perhaps the most important aspect of Crawford's work, for example, was his promotion of aerial photography as an archaeological tool:

> I find it difficult to express in suitable words my sense of the importance of air-photographs for archaeological study… [they] will prove as valuable to archaeology… as the telescope has proved to astronomy. They are not a substitute for fieldwork, but they are the most powerful ally of the field archaeologist (Crawford 1923: 358).

In addition to the identification of archaeological features, Crawford also advocated the application of aerial photography as a means of producing accurate distribution maps to allow further interpretation (Bowden 2001: 37). For example, he illustrated his 1923 lecture on newly recognised field systems with maps showing the differences in distributions of Celtic and Saxon settlements on Salisbury Plain (Crawford 1923: 354-355, figs. 1-2). The aerial photographs not only facilitated clarification of earthwork morphology, but also enabled stratigraphic relationships to be defined among what appeared to be "homogenous networks" on the ground (Crawford 1923: 346). The benefit of an 'integrated' approach is a recurring theme throughout Crawford's work - long before it became a twentyfirst-century buzzword - and he regularly emphasized the use of aerial photography in conjunction with excavation and stratigraphic dating (e.g. Crawford 1923: 343).

The general approach to field systems at this time, which reflected fashions elsewhere in archaeology, tended overwhelmingly towards identification, description and categorization. While Crawford used his accurate plans to determine whether field groups followed any common geometric or distributional rules, the Curwens focussed on the identification of Celtic fields from evidence for the processes and tools that made them. This included grain, plough types, sickles and querns, with the addition of ethnographic comparisons with the ‘primitive’ ‘Celtic Fringe’ of Britain, from which a chronological order of field systems was produced (Curwen 1927: 274-8, figs. 1-7, 9-12) (fig. 2.1).

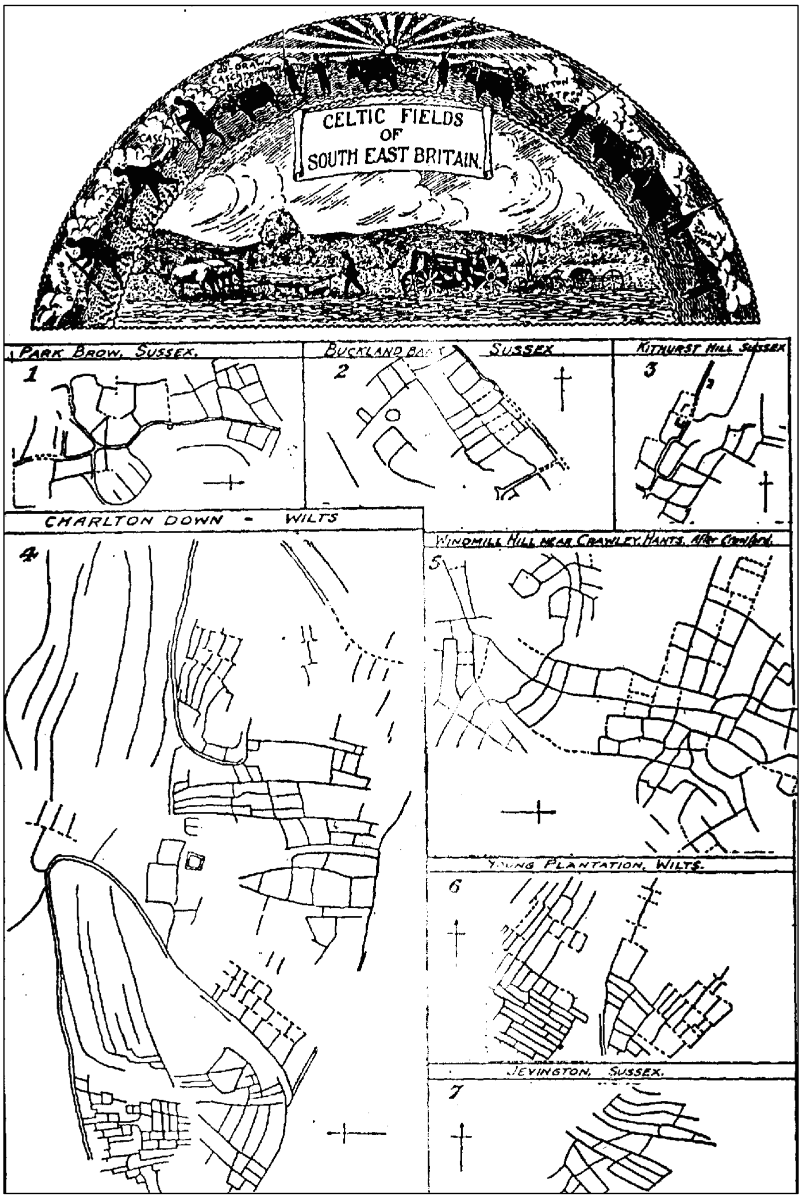


Fig. 2.1 Curwen’s 1927 diagrammatic representation of subcategories of prehistoric ‘Celtic’ fields of southeast Britain; the subcategories include long strip fields parallel to the contour, strips at right angles to the contour divided into squarish/rectangular plots, and irregularly arranged squarish plots. (Reproduced from Curwen 1927: 276, fig. 1-7.)

Independently of the work of British scholars (see Hatt 1931: 146), their European counterparts were also recognising and producing analogous work on early field systems in northern parts of continental Europe. For example, van Giffen published a description of an area of ancient cultivation overlain by Iron Age burial mounds near Zeyen, Drenthe (Netherlands), proposing that the rectangular fields were of Celtic origin (van Giffen 1928). Hatt identified five types of abandoned fields that survived on the heaths and woods of Jutland (Hatt 1931). Of these types, he deemed at least three to be prehistoric. Type III, of which examples at Fogstrup Heath near Silkeborg were the subject of an unpublished 1921 study by Johansen (see Hatt 1931: 121), consisted of long, parallel strips of land approximately 11m wide, separated by rows of stones, with associated clearance cairns; associated potsherds determined an early Iron Age date. Hatt's Type IV fields, examples of which were widespread across northern and western Jutland (1931: 149-153, fig. 18), were rectangular, enclosed by baulks formed by the accumulation of vegetation, cleared stones and plough-dragged soil, and dated to the Pre-Roman Iron Age. This category bears close resemblance to the 'Celtic' fields identified across southern England. Type V fields were described as being, on the whole, evidence for earlier prehistoric cultivation, comprising clearance cairn fields without specific field boundaries (Hatt 1931: 156).

At the same time as archaeological awareness of agricultural remains increased, the rate at which evidence was being destroyed was also increasing: in his 1935 study of 'Celtic' fields on the South Downs, Holleyman noted the rapid encroachment of intensive ploughing and building (and their associated archaeological problems) on areas of lynchet groups near Brighton (1935: 445-6). Holleyman intended to broaden the study of British field systems beyond the mapping of those of Wessex and Sussex, and took an approach that linked the large tracts of ancient 'corn-growing' land (from Bronze Age to Romano-British date) with both the local topography of the Downs and contemporary settlements by which the land was apparently controlled. He concluded, for example, that field systems were predominantly found on the upper slopes, but not the main ridge, of the Downs, while their extent implied peace and prosperity, and confirmed the observations of classical texts that southern Britain was a centre of corn production (Holleyman: 1935: 454). In a pre-WWII summary of work on ancient field systems, Barger highlighted the problem that distribution maps represented the distribution of work more accurately than they represented the original distribution of field systems; the intensive ploughing of the twentieth century not only destroyed the archaeological evidence, but skewed the geographical interpretation as a result (Barger 1938: 389-90).

2.1.2 The 'Hoskins Effect'

While work on prehistoric agriculture inevitably remained disparate in the years through and immediately following WWII, in 1957 the British Association for the Advancement of Science held a symposium on Ancient Agriculture, the outcome of which was the formation of the Research Committee on Ancient Fields. Although of limited impact in practice, it seems to have provided an umbrella under which to establish a sense of direction and leant a mild flavour of 'scientific' authority. Bowen's related publication, *Ancient Fields: a tentative analysis of vanishing earthworks and landscapes* (1961), remained the standard reference on early field systems for over 15 years, and made a deliberate attempt to focus on processes (of field formation and agriculture) and definitions as opposed to reviewing the evidence again: it "was intended to be a primer not an inventory" (Bowen 1978: 1). Perhaps most importantly, Appendix A comprised a proposed research agenda, which listed the most 'urgent problems', and which focussed on the accurate identification, recording and preservation of evidence through detailed study (Bowen 1961: 61-62). To this end, Appendices B and C comprised prompt sheets for recording Celtic and Strip field systems (Bowen 1961: 63-64). The success with which the research questions (relating to aspects of date, use and character of the fields and boundaries) have so far been answered is mixed and it seems that the same, or related, aims continue to drive current research.

Bowen's rationale behind his research agenda lay in his view of the importance of field systems to the landscape and countryside as a whole: he argued that their correct interpretation underlay that of the wider countryside due to the extent of land that they covered, their reflection of broader traditions and their association (given their size) with so many other earthworks (Bowen 1961: 1-2). In such an approach can be seen the influence of the wider context of the early evolution of 'landscape archaeology' as a discipline in itself around this time, in its manifestation as a close relative of historical geography and landscape history, with strong emphases on local history and the study of the minutiae of 'everyday life'. In particular, Hoskins' work *The making of the English landscape* had challenged the status quo in 1955, in an attempt to address a situation whereby, despite the multitude of books on English landscape, scenery and topography, "there is not one… which deals with the historical evolution of the landscape as we know it" (Hoskins 1981: 11). The consequent development of a holistic approach to landscapes, coupled with attempts to make local landscape history more accessible, has remained an influential method within the discipline (see, for example, Aston 1985; Muir 2000).

Hoskins' attempt to "study the development of the English landscape much as though it were a piece of music, or a series of compositions of varying magnitude, in order …[to understand] the whole" (Hoskins 1981: 20) is now well known, however, so are its shortcomings. It can be a noticeable feature of such approaches to landscapes that the 'labelled' field systems (and other categories of landscape element) get caught in an artificial periodization of landscapes that are treated as a series of separate time slices (reminiscent of Crawford (1923) or Curwen's (1927) treatment of the distinctions between 'Celtic' and 'English' agricultural remains). This can generate a somewhat static interpretation, implying discrete periods of progress rather than allowing for continual idiosyncratic influences. Indeed, Chadwick argues that metaphors such as 'palimpsest' and 'fossilization' should be deliberately avoided, due to the implicit impression of inevitability in the accumulation of feature-types and limited appreciation of the subtleties of their role in later times (Chadwick 2008a: 6-7).

In addition to the firm foundations that historical geographical approaches leant to 'landscape archaeology', and alongside the decline of culture historical approaches, the development and incorporation of various 'scientific' techniques facilitated closer investigation into multiple aspects of the wider landscape: environmental analyses, soil micromorphology, faunal remains studies, geophysical methods and geochemical survey continue to provide valuable information relating to field systems, particularly when combined to offer complementary datasets. While some large projects, such as that on the Marlborough Downs (Gingell 1992) were already in progress, these tools, along with a growing confidence, allowed increasingly ambitious work to take place over the following decades.

2.1.3 Empirical discoveries of the 1970s and 1980s

Fig. 2.2 A reave on Dartmoor, marked by the change in vegetation. Part of the southern Dartmeet system. Photo: author.

During a 1972 field trip, Fleming and Collis made an observation that had a considerable impact on the development of work on field systems. Interested in prehistoric remains on Dartmoor, but surprised that the area had been largely neglected after early attention from antiquarians, they deduced that the dry-stone ‘reaves’ that extend for many kilometres across the moorland (fig. 2.2), and which had been generally presumed to be of medieval origin, were in fact prehistoric on the grounds of the relationship of an individual reave to a D-shaped prehistoric enclosure (Fleming 2008: 7). The excellent survival of the boundaries has since enabled their extent to be mapped across extensive areas of upland (primarily through walkover survey), this process being conducted with the intention of understanding the overall pattern of layout. A number of specific characteristics of the features were noted, including the regularity with which groups of parallel reaves ended at a ‘terminal reave’ running perpendicular to the axis (the terminal reave often running parallel to a watercourse), the frequency with which reaves appeared to continue directly across naturally difficult terrain with few concessions to steep topography or similar, and the grouping of reaves into ‘block systems’ across the moor, which were interpreted as relating to territorial divisions (Fleming 2008: 52-73). Specific investigation was made of an individual system, namely the Dartmeet System, in terms of agriculture, settlement, movement of people and animals, and ramifications for ‘community’; such investigation was conducted through the mapping of earthworks in combination with excavation, and has since been extended to examine evidence of several field systems across Dartmoor (Fleming 2008: 74-118).

The work on Dartmoor has proved extremely influential, not least because the preservation and scale of the evidence, situated in a dramatic modern landscape with assorted prehistoric monuments, makes images of the systems unforgettable. The momentum generated by a high profile new discovery in an area of archaeology that had not recently experienced this, was manifest as infectious enthusiasm, and the late 1970s and 1980s saw a flurry of papers identifying coaxial and other prehistoric field systems across the country. A large number of local and regional studies exist, primarily driven by observations and mapping relating to the presence, extent, date, method of layout and agricultural uses of fields, although the initial reconnaissance work has often been returned to and provided a useful foundation for later work; examples include work on fields on Salisbury Plain (Bradley *et al*. 1994; McOmish *et al*. 2002), the Marlborough Downs (Gingell

1992; McOmish 2005), Fyfield Down and Overton, Wiltshire (Fowler 2000), South Yorkshire (Riley 1980), Scole-Dicklebugh, East Anglia (Williamson 1987; 1998), Bristol (Fowler 1978), the Berkshire Downs (Bradley & Richards 1978), the North Yorkshire Moors (Spratt 1981) and Cumbria (Higham 1978). The renewed wave of discovery also spilled over across the North Sea and English Channel, stimulating investigations across northern Europe: extensive 'Celtic' field systems were identified in the Netherlands (Brongers 1976), Northern Germany and Denmark (Müller-Wille 1979; Behre 2000). This vein of research - the identification and study of regional field systems - has proved very productive since, with the corpus of known evidence and the geographical extent of such monuments gradually being extended. More recent examples include investigations across northern Europe (including, for instance, in Sweden (Petersson 2008) and Estonia (Lang 1994)), and the use of recent technological developments and novel approaches such as lidar prospection in the central Netherlands (Kooistra & Maas 2008), the use of lidar to identify archaeological remains beneath woodland on the South Downs (Thorne & Bennett 2015) and the measurement of the rate of bedrock dissolution as a field-wall dating technique at Roughan Hill, Co. Clare, Ireland (Jones 2016).

It is apparent from the publications of the last quarter of the twentieth century that although various authors were identifying coaxial field systems and reaching similar types of conclusions across Britain, these were achieved through the employment of a variety of methods. Whereas Fleming's recognition and interpretation of archaeology was based on careful field survey, involving walkover investigation and targeted excavation (Fleming 1978; 1983; 2008), Williamson, for example, identified pre-Roman coaxial fields in East Anglia through map regression, revealing that the alignment of the fields disregarded, and therefore predated, that of a Roman road (Williamson 1987; 1998; Hinton 1997). In the Netherlands, Brongers used aerial photographs to identify and trace prehistoric field systems (Brongers 1976), as did Riley in South Yorkshire and North Nottinghamshire (Riley 1980), while the Neolithic fields at Céide were mapped by probing the peat from the surface to establish the presence and direction of walls (Caulfield 1978; 1983) (Fig. 2.3).

Fig. 2.3 View across Céide Fields towards the visitor centre and the coast. In the foreground, the canes mark a probing transect in progress - those that haven't sunk into the peat so far have been stopped by the stones of a wall of the field system beneath the peat. Photo: author.

The majority of work at this time remained largely geographically focussed, a notable exception being Bradley's 1978 study of prehistoric field systems, which deliberately employed a comparative approach, discussing the distribution, chronology and significance of field systems across north-western Europe. Developments in the study of Early Land Allotment were brought together by a symposium on the subject in 1976 (Fowler 1978). The stated aim was to build on Bowen's gazetteer published 15 years previously (Bowen 1961) to publish an up to date corpus of knowledge, although such publications inevitably become rapidly outdated; however, the meeting itself provided an invaluable chance to bring together regional work and researchers for discussion (Bowen & Fowler 1978). A similar event and resulting publication were also organised for the consideration of Upland Settlement, and included work pertaining to prehistoric field systems (Spratt & Burgess 1985).

2.1.4 'Form, function and concept'

Whereas the approach of archaeologists in the first part of the twentieth century had revolved around the delineation and typological categorization of field *form*, and the work of the 1970s and 1980s considered form (including dating) in conjunction with *function*, it was not until the 1980s that prehistoric field systems were addressed in terms of their form, function and underlying *concept* (Fleming 1987).

Central to this discussion, Fleming confronted questions relating to the origins and underlying meanings of the coaxial systems, specifically their roles in explaining why field systems of coaxial form appeared to have been constructed in the same manner (and, it was reasonable to assume, for the same reasons), despite their recurrences being separated by time and space (Fleming 1987). While acknowledging that a number of physical features and geographical conditions were common to the systems, he was sceptical as to the capacity of functionalist arguments to fully explain the constructions and argued that the practical/essential nature of food production did not necessarily preclude the involvement of a symbolic element either in their formation or maintenance (Fleming 1987: 197-198). Moreover, his arguments centred on wider implications for the structure of the society that the field systems represented, weighing up interpretations of their presence as having been imposed from above against a model in which they were created in a more *ad hoc* manner by their users, and focussing on discussions of the capacity of prehistoric society to organise a labour resource; in so doing, the issues of importance were identified as invisible social forces only indirectly apparent from the archaeology, as opposed to the quantifiable measurements of the physical fields. These discussions took place against a backdrop of changing views of the structure of Bronze Age society derived independently of the study of field system evidence, including, for example, interpretations mooted by Barrett & Bradley (1980), Thorpe & Richards (1984) and Rowlands *et al*. (1987) relating to periods of social and economic transition and the interaction of elements within society.

Since Fleming wrote this article, and others (e.g. 1994) stressing the possibility of boundaries as an outcome of local communities dealing with pressure from exploitative elites, further campaigns of fieldwork on Dartmoor - which now contains some of the most comprehensively studied field systems in Britain - have led other authors to develop interpretations of the social pressures in which the boundaries have their origins. Where Fleming argued that the building of the reaves marked a single time-horizon, transformative, planned response to a Commons Dilemma (1994), Johnston cites excavation evidence running contrary to this interpretation to suggest an alternative, accretive sequence of boundary construction - taking place over a short or long time - in response to existing patterns of tenure, access and land use, with the conclusion that boundary layout was not a single, unified action (Johnston 2005). Wickstead has developed the theme of interpreting boundaries as representative of tenure, rather than purely functional features (Wickstead 2008b).

Over the last decades, archaeology in general, and landscape archaeology in particular, has responded to the emergence of post-processual, experiential approaches to landscape interpretation (Brück 1995; Tilley 1994; 2004; 2010; Ingold 1993). Such approaches are now being applied directly to field systems (e.g. Bender *et al.* 2007; Breen 2008). Such phenomenological outlooks have sought to humanize the landscape by drawing out the significance of features beyond the purely functional and emphasizing the roles of landscape components such as biography, memory, social meaning and sensory perception in an attempt to understand how past inhabitants interacted with their surroundings. While the availability of this manner as a further critical awareness tool would undoubtedly be considered beneficial to the archaeologist attempting to interpret the cultural landscape, it is to be borne in mind that such an approach has its limitations: considering that the method depends to such an extent on personal experience, the degree to which it is 'repeatable' (and the requirement for it to be so) is debateable; it is also particularly easy to read too much into evidence (Barrett & Ko 2009) and Chadwick suggests a complete understanding of the quantifiable evidence is essential prior to applying more abstract interpretations (Chadwick 2004).

The effect of the incorporation of such ideas into the discussion has been to change the direction of the approach to the study of field systems again: the most recent summary of work on the topic (Chadwick 2008c) is only partially based on relaying evidence *per se*, with the majority of articles drawing attention to new ways of approaching fields and their meanings. Indeed, Chadwick argues that, with a few notable exceptions, field systems are generally still primarily considered a proxy for agricultural economy and approaches must be updated to incorporate the theoretical advancements necessary to "write the fine grained archaeologies" (Chadwick 2008b: 205).

A number of recent studies have looked for direct manifestations of conceptual possibilities: the alignment of the dominant axes of coaxials on solstice sunrises or solar arcs has been suggested and tested (McOmish *et al*. 2002; Yates 2012), as has the alignment of field boundaries with earlier burial monuments (Bradley *et al.* 1994); recovery of human cremations from field boundaries and fields raises the possibility of fields as dynamic monuments built on complex cosmological foundations (Yates 2012: 292); the appearance of lowland coaxial field systems in the mid/lower Thames Valley have been linked with ring works and concentrations of deposited metalwork, perhaps indicating a link between intensification of agriculture and political ascendancy (Bradley & Yates 2007). More fundamentally, Gosden (2013) has considered the intrinsic character of the field as a distinct unit, challenging the assumptions behind analyses of the field as a purely functional entity or as a symbolic creation (though these approaches need not necessarily be mutually exclusive). It may be that the traditional view of field systems as stemming directly from the practicalities of keeping livestock or growing crops is too narrow a viewpoint: not only is the creation and maintenance of the boundaries filled with social meaning (see also Johnston 2005; Chadwick 2008b), but it is suggested that the standing boundaries also may be commemorative (Gosden 2013).

2.1.5 The impact of developer-funded archaeology

In the 20 years or so since the introduction of PPG16 (DCLG 1990) and the execution of specific archaeological investigations by commercial units as a component of planning requirements, the resulting project reports - usually in the form of the unpublished ‘grey literature’ archive - have become a valuable resource for the study of field systems. A number of large-scale excavations have proved to be particularly significant, such as that at Heathrow Terminal 5, which revealed a complex multi-period landscape (Lewis *et al*. 2006; 2010). In South and West Yorkshire, commercial interventions have provided the opportunity for excavations such as those at Armthorpe (South Yorkshire), of brickwork field systems that were previously known from crop marks and geophysical survey. Not only were the field systems significantly more extensive than previous techniques had detected, the excavations revealed a considerably greater complexity of alignment, as well as multiple recuts, of the field boundary ditches, suggesting that layout was not as rigid as had previously been assumed from the morphology of similar systems (Roberts 2008: 192-3; Chadwick 2008b: 224-226).

Despite the determination of the deployment of commercial resources by the details of individual development projects rather than academic research questions, a particular strength of the excavations and geophysical surveys is that, cumulatively, they cover such a large area – both in terms of the total hectarage of work carried out and in cumulatively providing sample windows distributed across the country. Moreover, the provision of funding in this way enables work to be done in places that would be unlikely to appeal to academic researchers otherwise, and has revealed what Yates views as “a scale of prehistoric landscaping without parallel to date in Europe” (2007: 13).

While increasingly intensive lowland agricultural regimes of the inter- and post-war years directed the attentions of some investigators towards visible upland field systems, modern development projects and their related archaeological surveys/interventions have occurred almost exclusively outside these areas. Yates has pointed out that this new data resource goes someway to redressing the balance, with the recent identification of Bronze Age coaxial field systems - marked by cut ditches rather than the stone reaves of their upland counterparts - across wide areas of the lowlands of the south-east and the Thames valley, and throwing the biases of previous research distribution into sharp relief (Yates 2007: 108). Two main phases of prehistoric land division have been identified, focussed around the middle-late-Bronze/early-Iron Age and the late-Iron Age/early-Romano-British period, with a 'real' distribution of lowland Bronze Age coaxial systems largely confined to the south of England (*i.e*. south of a line joining Bristol to the Wash) (Yates & Bradley 2007: 110-112). While this evidence is of considerable importance for the interpretation of the Yorkshire Dales coaxial systems in their wider geographic and cultural contexts, the direct impact of the developer-funded system has been limited in the National Park, given the statutory and geographical restrictions on building projects in the area.

2.2 Previous work on prehistoric field systems in the Yorkshire Dales

PREHISTORIC ENCLOSURE, GRASSINGTON.

Fig. 2.4 Antiquarian exploration of a 'prehistoric enclosure' above Grassington, Wharfedale (Reproduced from Speight 1900: 429).

The first documented investigations into the prehistoric field systems of the Yorkshire Dales were made by the antiquarians of the late nineteenth century. Spurred on by archaeological discoveries elsewhere in the Craven district earlier in the century, such as those at Victoria and Elbolton Caves (Tiddeman 1875; Jones 1888), attention focussed on areas such as Upper Wharfedale, where settlement earthworks appeared to be associated with the field boundaries. The Reverend B.J. Harker initially identified “quite a number of Druidical circles, dotted over the hills and pastures, with barrows and British forts...[and]...a supposed Roman camp of vast area” in the Grassington area (Harker 1892: 147), and the valley sides between Kettlewell and Kilnsey were described as containing “not a rood of ground without some evidence of ancient occupation” (Speight 1900: 427). Following Harker's excavation - which was described as a “marked success” (Speight 1894: 374) - of a barrow near Grassington containing a twisted cord Bronze Age beaker, the Upper Wharfedale Excavation Committee was formed (Speight 1894). Affiliated with the Council of the Yorkshire Geological and Polytechnic Society, and with the involvement and patronage of Professor Boyd Dawkins and the Duke of Devonshire among others, the Committee focused their activities on the area between Grassington and Conistone, noting that despite damage caused by stone removal for later building and stone-walling, the evident remains were extensive yet previously little examined (Speight 1894: 374).

Within two years the Committee had examined barrows on Capstick Pasture, Conistone, and a 'suspicious looking mound' and disturbed barrow on Lea Green, Grassington. A large number of flint tools were recovered from the area and 22 trenches were dug over numerous enclosures and fireplaces on Lea Green, as well as enclosures in Grass Wood that were dated to the third/fourth century AD by around 400 sherds of Romano-British pottery and a bronze coin of Constantine the Great; it was emphasized, however, that the "primitive" nature of the enclosures precluded any direct Roman occupation of the district (Speight 1894: 383; Speight 1900: 427-433). It was

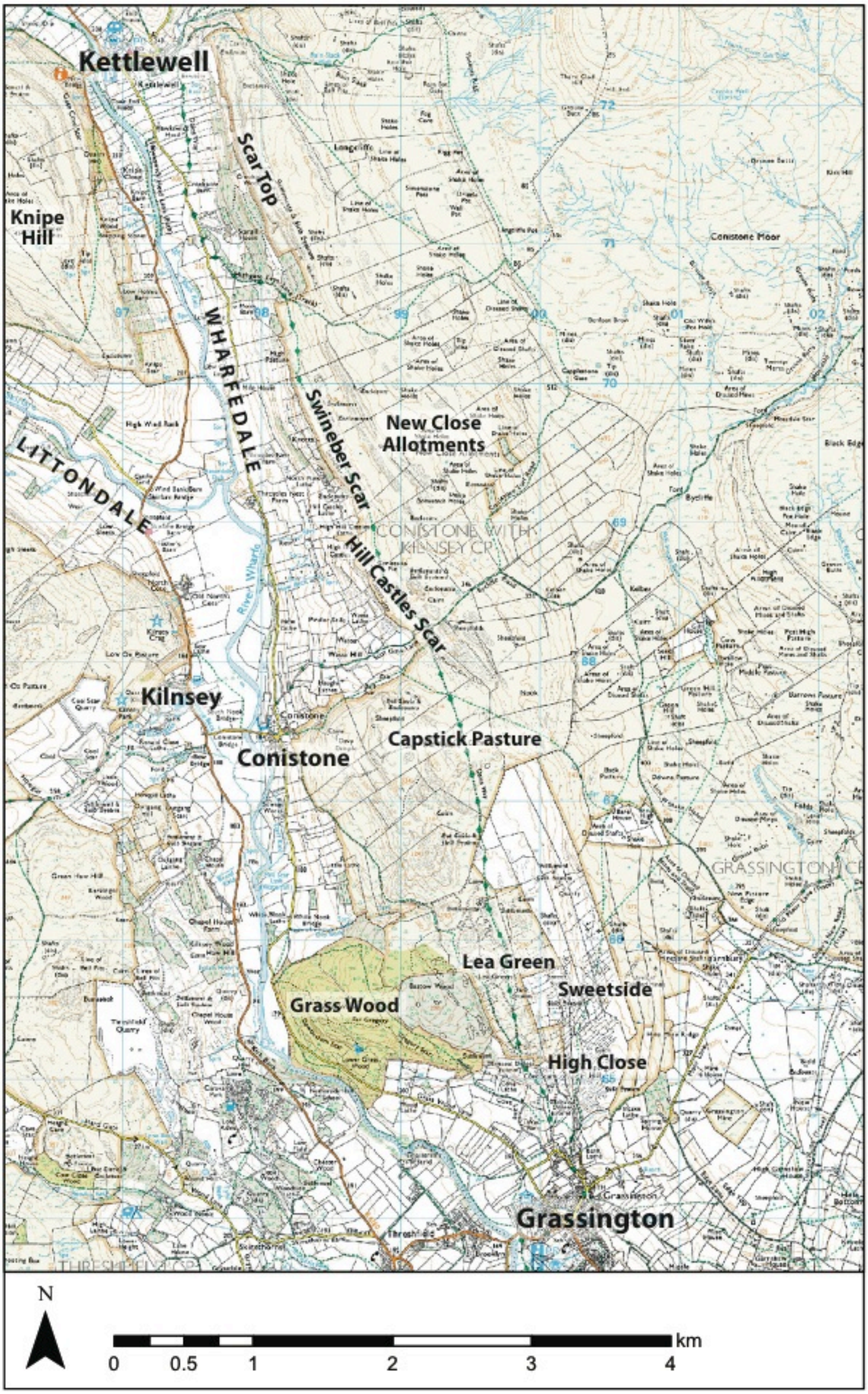


Fig. 2.5 Map of the Grassington area including sites mentioned in the text. (Ordnance Survey 1:25 000 Edina Digimap 2015.)

intended that four to five further seasons of digging, plus planning and photographing of finds would take place, however, the Committee dispersed in 1894. John Crowther, a local Antiquarian and founder of the Wharfedale Antiquarian Society, continued to conduct similar investigations at High Close and Grass Wood, some of which were published posthumously in 1930 (Crowther 1930).

It is striking, though perhaps inevitable, that in most cases the documentation relating to these studies is minimal, comprising lists of skeletons and finds (mainly flint, bronze and iron) with a rudimentary description of their location. It is noticeable that the success of these excavations was measured by the number and curio-value of skeletons and metal finds of which the barrows could be "relieved" (Harker 1892: 147); it is telling that Harker judged his first excavation - of two small mounds from which no artefacts were recovered - to have yielded “no satisfactory results” and turned instead to the largest mound (Harker 1892: 147). Interpretations were further limited by the assumptions from which they were derived, for example, that the “prehistoric city” above Grassington only came into existence shortly before the mid-second century AD on the grounds that, in contrast to Ilkley, it is not mentioned by Ptolemy (Speight 1900: 427-29); similarly, the lack of any bronze, iron, silver or gold finds in a barrow was proof of a stone-age date (Harker 1892: 148). While some of these finds remain in local museums, many have been lost.

Focus was placed on the field systems of Upper Wharfedale again in the 1920s: Curwen, informed by work on prehistoric agriculture and cultivation that he had previously conducted in southern England (Curwen 1927), undertook investigations into the size and construction of the lynchets that formed part of what he referred to as areas of ‘Celtic cultivation’ on High Close Pasture, Grassington (Curwen 1928) (fig. 2.6). Arguing that the farmers of these fields would have lived closer to them than the settlement evidence unearthed approx. 1.5km away by the Upper Wharfedale Exploration Committee, his primary aims appear to have included the location of 'hut circles', perhaps as a means of recovering artefacts to

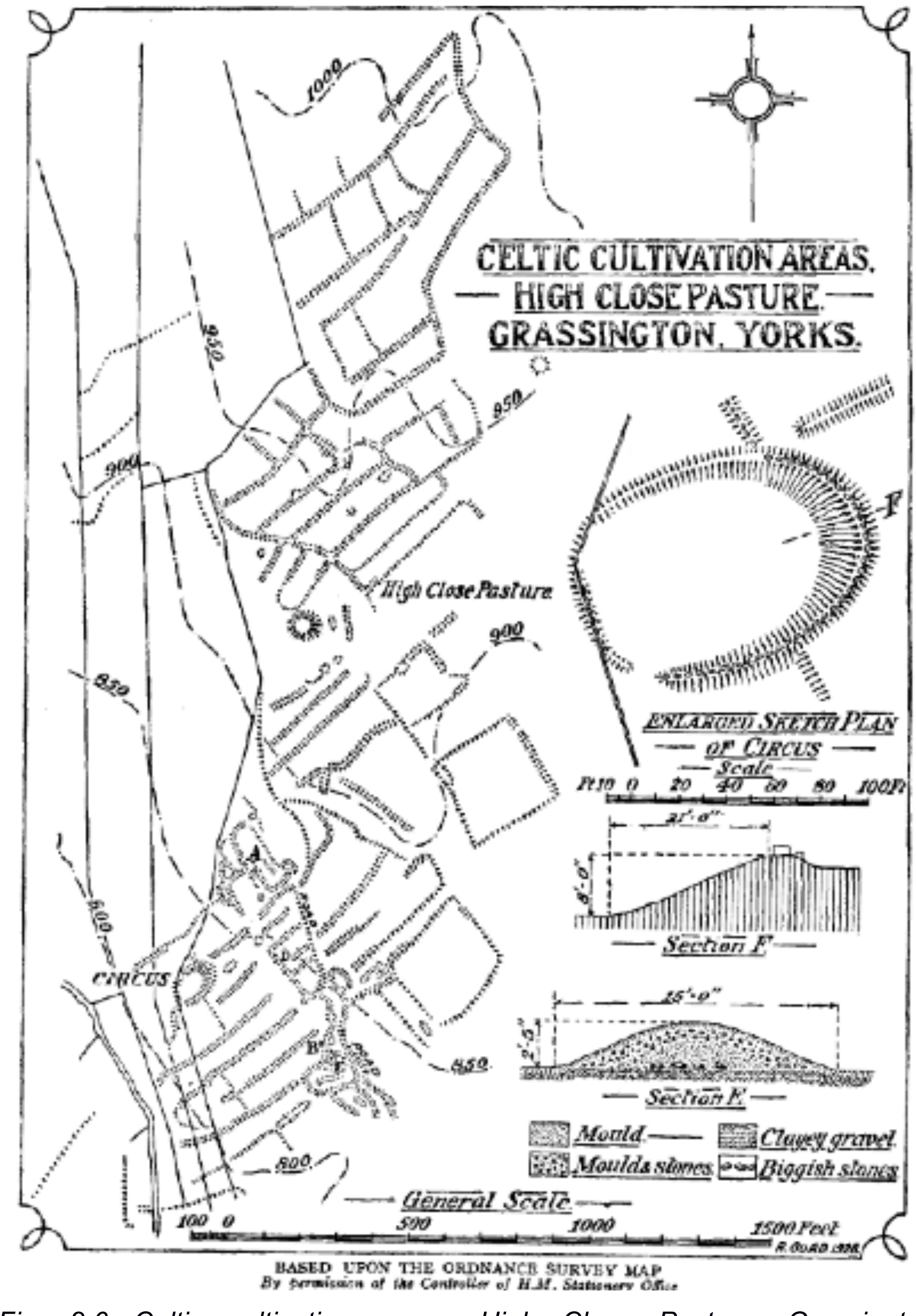


Fig. 2.6 Celtic cultivation areas, High Close Pasture, Grassington. (Reproduced from Curwen 1928: 170).

provide dating evidence; although these were not forthcoming, his examination of an oval feature likely to be one of Harker's 'Druids' Circles' led him to interpret it as a communal meeting place of the Iron Age, a blend between the stone circles of north-west Britain and the earthen 'circuses' of less stone-plentiful areas (Curwen 1928: 171).

While Curwen continued to take the traditional site-by-site approach to the archaeology of this area, his work contrasts somewhat with that of Raistrick, who, as civil engineer and geologist by training, adopted an approach to archaeological observations that was biased towards the landscape as a whole. Raistrick’s outputs on Dales and Pennine archaeology were both prolific and varied, focusing particularly on buildings, stone walling, place names, prehistoric earthworks and, not un-related to his entrenched socialist views, industrial archaeology (Raistrick 1948, 1965, 1968, and 1972 among others). Between 1919 and his death in 1991, provoked by the “very inaccurate and inadequate” descriptions and interpretations of earthworks above Grassington by nineteenth-century antiquarians (Raistrick 1937: 166), Raistrick undertook mapping and test-trenching of extensive areas of Upper Wharfedale.

His pioneering manner included the incorporation of palynological techniques to archaeological situations, stemming from his development of the use of pollen in identifying coal measures during his PhD. Although he did not make substantial use of aerial photographs, commenting that it was a “matter of interest and encouragement” that the images did not illuminate any significant features that had not already been located by ground survey, he acknowledged that in places they added detail which would have been difficult to obtain on the ground (Raistrick 1937: 167). He did, however, make considerable use of OS maps - working for a time as an archaeological correspondent for the Ordnance Survey - that his ground survey allowed him to annotate and correct. His work often demonstrates an amalgamation of artefactual evidence with the interpretation of surveys conducted over a range of site types; the distribution patterns of such occupation is then considered against the background of his comprehensive experience of the Dales terrain, and alongside broader environmental factors such as contemporary climatic conditions (see, for example, Raistrick 1929 and 1939; Raistrick & Chapman 1929).

Fig. 2.7 Raistrick's map of prehistoric cultivations at Grassington. (Reproduced from Raistrick 1937: fig. 1.)

Studies of the archaeology and geology of the Yorkshire Dales have been somewhat dominated by Raistrick, whose numerous pamphlets, books and articles detailing the area have subsequently cast a long shadow over Dales archaeology; while his work has undoubtedly served to impress the landscapes and resources of the Dales and northern Pennines firmly on the public consciousness, his prolific output tended to be aimed at the popular, rather than academic, market. It is also underpinned by a frustrating disregard for the provision of references and a habit of presenting sweeping, generalized statements as fact (e.g. Raistrick 1968). A similar tendency is visible in his unpublished work, which, for example, includes numerous examples of annotated sketch maps with omissions such as locations or symbol legends - information clearly too obvious to Raistrick to warrant inclusion - thus requiring their decoding before the maps can be put to use. Roe, working on the archaeology of lead mining, has suggested that this legacy inhibits further understanding of such landscapes and perpetuates fallacies that are only now being overturned through the use of new technology (Roe 2003:65). In particular, he argues that the mining landscapes of the Dales need to be reassessed using up-to-date GPS and phenomenological approaches in order to pay more attention to details such as variation in mine roof levels, above-below ground links, and the ephemeral evidence of hand or hoof prints which illuminate the human experience of the mining landscape as a step beyond the geological evidence alone (Roe 2003). Something similar could arguably be said for the coaxial landscapes around Grassington. It has also been pointed out that Raistrick's excavations consisted of little more than stripping turf and planning the visible archaeology, with limited scrutinization of stratigraphy or appreciation of multiphase use (White 2002); his records, both published and unpublished, of such investigations often consist of exasperatingly perfunctory notes which give only a cursory, and sometimes misleading, impression of the site.

Attention paid to the coaxial systems of the Dales trailed off somewhat in the second half of the twentieth century, until, in the wake of work on the Dartmoor reaves, the early 1980s saw the beginning of work on coaxial systems in the vicinity of Reeth, mid-Swaledale (Laurie 1985; Fleming & Laurie 1984-1993; Fleming 2010; Laurie *et al*. 2011). The resulting Swaledale Ancient Land Boundaries Project (SWALB) has focussed on conducting specific field survey, and some limited excavation, of both coaxial boundaries and a large number of potentially associated features including cairns, burnt mounds and settlement remains; a number of individual coaxial field systems have been isolated and traced within the dale (both within and outside the National Park boundary), and up to three general phases of usage interpreted (Fleming 2010). The earliest of these is interpreted as a phase of 'cairnfield settlement', reflective of seasonal, transhumant settlement out of which the main coaxial settlement developed; the main period of coaxial fields and associated settlement is supposed to have lasted for a considerable period of time, before giving way to a later phase which consisted of lynchetted field systems on the lower date sides (Laurie *et al*. 2011: 40). In places, limited floating chronologies have been established and radiocarbon sampling undertaken (although this has proved problematic). This project comprises the most extensive and sustained campaign of work carried out on Dales coaxials to date - though it treats the Swaledale examples entirely in isolation. It would benefit from the publication of a full final report.

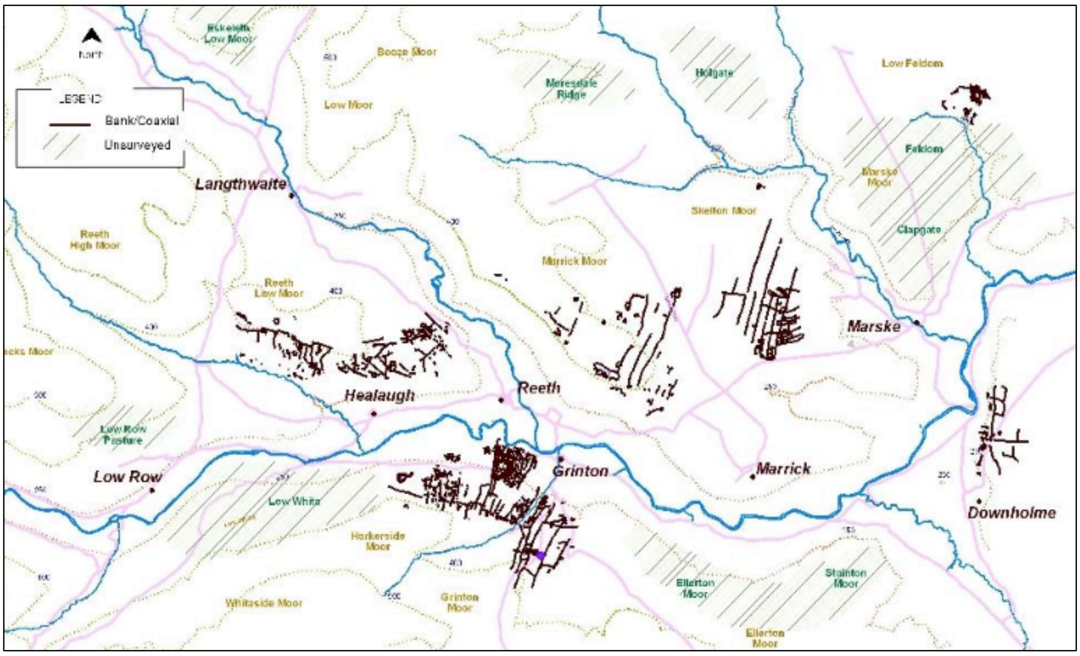


Fig. 2.8 Coaxial field systems in Swaledale identified by SWALB. (Reproduced from Laurie et al. 2011: 37, fig. 6.1.)

While SWALB worked at the scale of the site and of the dale, the Yorkshire Dales Mapping Project, conducted by the Royal Commission on the Historical Monuments of England (RCHME), provided a more broadly based, National Park-wide background around this time (Horne & MacLeod 1995). The project, which covered *c*.273,000ha of the Yorkshire Dales, served as an upland zone pilot for a subsequent national project and was designed to develop methods of rapid mapping of earth- and stoneworks and computerized recognition of cropmarks in order to enable systematic analysis of aerial photographs. The project identified over 18 200 individual sites, many of which formed part of larger archaeological landscapes, with an estimated 30% of Prehistoric and Roman records comprising previously undocumented sites (Horne & MacLeod 2004: 15-18). In terms of coaxial field systems, while the existence of several had previously been known, the RCHME Project was able to acknowledge up to 40 possible systems requiring further investigation (Horne & MacLeod 1995: 33-41).

The initial study was augmented by a field course run in association with Leeds University Department of Continuing Education, allowing more intensive field work focus on a small study area located above Conistone, Wharfedale, which had been selected for its archaeological potential (Horne & MacLeod 2001). While serving to illuminate the strengths of the original Mapping Project work, the conclusions of the extended study highlight the additional value of both locating and understanding the archaeological features, which the associated field observation has allowed; this has proved particularly valuable with regard to assessing chronological relationships between features, thus enabling interpretation of the development of the landscape over time.

Recent field investigations in the Dales have tended to be more fragmentary, although undertaken with no less attention to detail or enthusiasm. Predominantly the work of community archaeological groups, significant new details have been added to the existing record. For example, continued work by the Yorkshire Dales Landscape Research Trust and Upper Wharfedale Heritage Group at Chapel House Wood, Wharfedale, has included topographic/geophysical survey and excavation – including radiocarbon dates – of settlement evidence perhaps related to field systems (Martlew 2013); walk over survey of earthworks at High Close Pasture, Grassington has also been conducted (YDLRT 2013). On a smaller scale, collation of lithic surface finds from the Grassington-Conistone area has been attempted, although difficulties in determining the whereabouts or existence of artefacts and attributing an accurate find spot has hampered analysis (Cherry 1998).

Constraining factors on such work have been acknowledged, however, and include a lack of integration between excavation, environmental and documentary evidence, a bias of site choice/artefact recovery towards the prominently visible, and the treatment of individual sites in isolation; a number of additional difficulties are inherent in the nature of the archaeology, including a lack of diagnostic artefacts from most sites, the unprovenanced nature of surface collections, and destruction by forestation or rabbits (Martlew 2004: 43-49). The limited threat of large-scale development in the Dales serves to preserve the archaeological record *in situ*, yet it also eliminates the possibility of extensive commercial investigation, which has proved invaluable elsewhere in recent years in providing large quantities of good quality data with a wide geographical spread (see above).

2.3 Geographical Information Systems in archaeology

This research makes use of a Geographical Information System (GIS) as a means to handle and marshal the data upon which it draws. Not only does the GIS environment provide a means to manageably retrieve, visualize and analyse increasingly large datasets, it also allows data to be articulated and manipulated in space and time.

Wheatley & Gillings have placed the emergence of GIS in archaeology firmly within the quantitative tendencies of the 1960s New Archaeology (Wheatley & Gillings 2002: 6-8). It offered a means by which, for example, examination of distribution maps - favoured by earlier archaeological practitioners as a means of representing the dispersal of cultures - could move beyond the visual and partial, towards the ‘scientific’ impartial. Having borrowed incentives, solutions and methods from various disciplines including geology and ecology, GIS techniques sidled into archaeology via cultural resource management, providing a convenient vehicle with which to handle the (predominantly spatial and increasingly large) datasets they found there. Momentum originally materialized in the US and was subsequently amplified in European spheres, with the result that capabilities, ease of use, flexibility and accuracies of GIS software developed rapidly throughout the 1980s and particularly the 1990s. Not least, the potential to combine and directly compare numerous data sources appealed to users in various disciplines, producing results that were in some ways more valuable than the sum of their parts.

By the end of the twentieth century, GIS and their related cartographic tools - not to mention the opportunities afforded by the world wide web - had arguably transformed approaches to data interpretation and problem solving in most spatial sciences (Kvamme 1999: 154). Although it was always possible for users to "stagnate at a level of drawing maps" (Lock in Lock & Stančič 1995: 1), a number of trends emerged that offered the facility to investigate new research questions. Kvamme identifies five such aspects, namely: locational/spatial analyses at a regional level, predictive locational models, spatial allocation (i.e. territoriality and cost surfaces), intervisibility (viewshed) analysis, and simulation, all of which have become firmly established mechanisms in archaeology.

An explosion of advances in both GIS and associated technologies in the early twenty-first century has seen reciprocal developments for all involved, with the capabilities of field equipment, computer power and software expanding in an upward spiral of growth and associated demands. Where Kvamme identifies the point of the main contemporary advances in GIS as improving mapping and recording capabilities and facilitating archaeological discovery, he also identifies the emergence of "a cadre of specialists in each domain" that is propelling a "culture of change" in the discipline (Kvamme

2012: 336). This particularly applies to disciplines such as geophysics and aerial prospection.

GIS are now widely considered to be standard archaeological methods, both in academic and commercial settings, and in many respects it would be thought inconceivable that projects of any scale could be conducted without them (at least in terms of data viewing/collation aspects of the project, if not also analysis); the GIS-based component of the programme of the Computer Applications and Quantitative Methods in Archaeology conference in recent years has illustrated its constant popularity and evolution. In their treatment of spatial information, it is possible to apply GIS to data of any scale and, hardware permitting, quantity. For example, focussing at the close up level, GIS has been used to conduct morphometric analysis of modern percussive stone tools used by wild chimpanzees: the topography of the tool surfaces was modelled through the creation of Digital Elevation Models and various Digital Surface Models - as would be landscape archaeology data - and these used, alongside visual analysis, to identify areas of polish, roughness and depressions that indicated particular patterns of use (Benito-Calvo *et al*. 2015). Similar positional approaches have previously been applied to cut marks on bones (Abe *et al.* 2002). At the other end of the archaeological scale (in terms of both physical scale and data volume), GIS plays an essential role in the handling, treatment, display and publication of information in 'big data' projects such as the English Landscape and Identity Project. The aims of the project include the analysis of data from a range of sources, including HERs and the National Mapping Project, which pertains to a considerable time span and broad geographical area - the parameters of the project are the 'English landscape 1500BC to AD1086'. Using both landscape-scale features and artefacts, the intention is to assess continuity and change in relation to identity and community (EngLaId 2014).

2.4 Summary

The overall picture of work on the coaxial field systems of the Yorkshire Dales is thus one of infrequent and irregular investigation, which has varied in both quality and imagination. In accordance with broader historical and national trends, flurries of activity have, for example, represented antiquarian activity above Grassington (although this mainly focussed on burial monuments, Raistrick's early work grew out of such mapping expeditions), and a resumption of interest in the 1980s in Swaledale. As such, the coaxial landscapes of the Yorkshire Dales are considerably under-studied compared with those of neighbouring regions (Oakey *et al.* 2015; Jecock 1998; Quartermaine & Leech 2012; Chadwick 2008b). While local landowners and farmers were probably aware of the presence of earthworks in their fields, additional systems beyond the most well-known groups were not formally identified until relatively recently (Horne & MacLeod 1995) and have not been the focus of academic interest until now.

3. Method

Previous studies of the prehistoric landscape of the Yorkshire Dales have been intermittent in quality and quantity, with only limited attention paid to the coaxial fields: the majority of systems have received no meaningful study to date. This research therefore takes a broad, landscape-scale approach in order to incorporate the existing evidence and establish common trends and patterns in the archaeological remains. In doing so, it acts as a foundation for future, more targeted, fieldwork.

A Geographical Information System (GIS) provides ideal tools to synthesize the spatial and temporal data available for the coaxial field systems of the Dales. It is well known that the evolution of accessible Geographical Information Systems has revolutionized archaeology in general, and the treatment of archaeological landscapes in particular. It has been almost 20 years since Gillings & Goodrick referred to GIS as being as much "a place to think as a simple data management and mapping tool" (Gillings & Goodrick 1996: 1.1), during which time the 'full potential' of systems has expanded considerably in terms of both the range of analyses and manipulation tools available and the type and size of data that can be accommodated. Nevertheless, Gillings and Goodrick's description remains true. The value of this "place to think" lies not least in the facility for both qualitative and quantitative analysis, allowing both inductive and deductive jumps to be made. As Neubauer has pointed out, the GIS concept has moved beyond a software for drawing maps, to become a standardized interface between archaeological/prospectional sources and their interpretation (Neubauer 2004). However far GIS capabilities are now being stretched, their potential is underwritten by the ability to handle spatial data accurately. The application of this characteristic need not be complicated to be effective or useful in the organization of archaeological data, particularly that related to landscape-scale features such as field systems. The research draws on the following resources, which have been evaluated and incorporated into the ArcGIS environment as appropriate. This chapter appraises the data sources and looks more closely at what constitutes coaxial systems within the parameters of this study.

3.1 Sources and datasets

3.1.1 Extant archaeology

The extant archaeology is, of course, the primary source for this study, and that from which many of the other datasets that have been combined in the GIS are derived. Many of the surviving coaxials are located on 'Right to Roam' land, although others are more difficult to access. Where possible, they have been visited and photographed (see Chapter 4), serving as a record of their condition as well as of their character. All the remaining evidence takes the form of earth and stoneworks, as opposed to cropmarks, which are not visible in this area due to landuse and geology. One of the greatest difficulties is assessing the extent to which evidence on the ground is a valid representation of the original field systems or just a surviving remnant. In many cases visibility on the ground is poor due to vegetation cover - although in places (particularly the heather covered moorland, where bilberry appreciates the slightly better drainage provided by the stone boundaries) it is only from the variation in vegetation that it is possible to discern the presence of archaeological remains. It is difficult to get an 'over view', given the scale of the systems, although it is worth bearing in mind that this is the view (as opposed to aerial views) that the builders of the systems would have had.

3.1.2 YDNPA Historic Environment Record

The Historic Environment Record, maintained by the YDNPA, acts as the central collection point for archaeological records relating to all periods from across the National Park, and as such is of great value to a project of this type, despite its inevitable limitations. Like any publicly funded organisation, the speed and accuracy with which it can be updated is reliant on the availability of resources; moreover, this increases the likelihood of any inaccuracies or out-dated entries becoming perpetuated and so fossilized. The database contains approximately 32,000 records (as of December 2013), with each individual record detailing the location, form, age and relevant sources for the given monument or find. Fig. 3.1 demonstrates the distribution of these finds and sites, the density of which corresponds noticeably with the topography of the dales - though this may say as much about the activity of the finders as the 'real' incidence of the archaeology. The HER contains some overspill *i.e.* records located outside the actual National Park boundary, which have been clipped out for the purposes of this research.

The HER also contains a collection of 'grey literature' pertaining to archaeological interventions within the Park's jurisdiction. Given the paucity of commercial archaeological interventions in the Dales, particularly at elevations coinciding with extant prehistoric field boundaries, very few relevant excavation reports exist. One exception to this is that for a pipeline passing through Appletreewick Pasture, which involved the excavation of three prehistoric field boundaries (Cardwell *et al*. 1990).

Available for consultation as an ExeGsIS HBSMR database and 'GIS portal', the contents of the database has been made available by the National Park Authority as a series of .csv files and .shp files, which could then be filtered and interrogated as required. Initial cleaning of the .csv file was conducted manually within Microsoft Excel - entries detailing medieval and later features, for instance, were separated (and have provided valuable information relating to apparent gaps in earlier archaeology). An attempt was made to simplify the numerous combinations of dating categories made possible by the database 'from' and 'to' fields and the thesaurus entry choices in the database, in order to allow direct comparisons; the records of prehistoric archaeology (1463 in all) were re-assigned manually to 'Early Prehistoric' (*i.e.* Palaeolithic to Mid Bronze Age), 'Late Prehistoric' (*i.e.* Late Bronze Age to Romano-British) or 'Prehistoric' (*i.e.* undifferentiated; could not be more precisely assigned), although in reality the vast majority were assigned to 'Prehistoric' as it was felt that many dates could not be

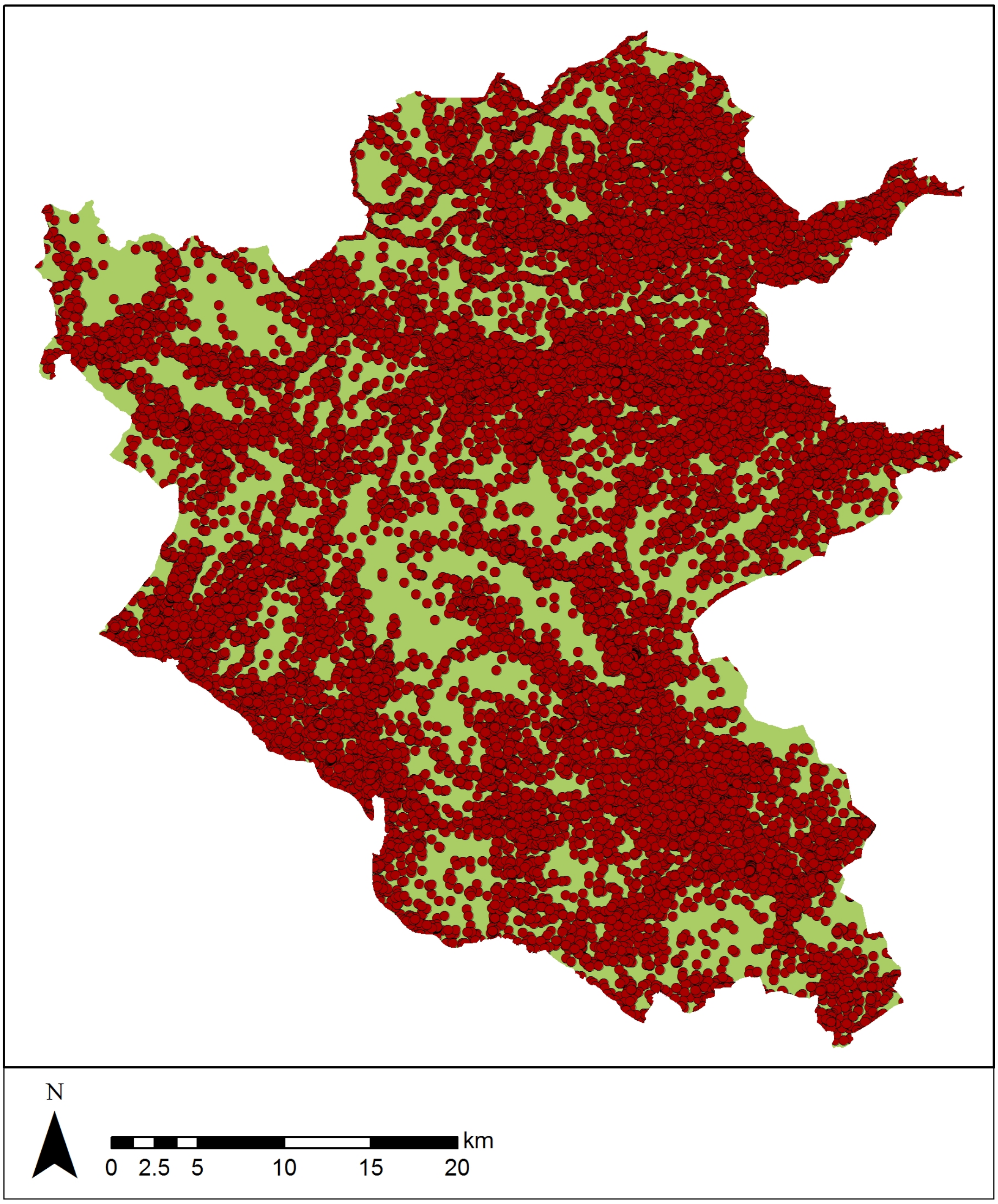


Fig. 3.1 Distribution of HER records as of December 2013. Note the correspondence with the National Park topography.

legitimately ascribed with greater precision and closer examination and full reassessment was beyond the scope of this project. All the records referring directly to agricultural features of any sort were then extracted from the prehistoric records and sorted to differentiate between systems confidently identified as coaxial and the remainder. When added to the GIS, this data provides geographically located point sources with additional data attached.

3.1.3 Yorkshire Dales Mapping Project

As noted above (Section 2.2), the Yorkshire Dales Mapping Project was a pilot scheme conducted by the Royal Commission on the Historical Monuments of England (RCHME) over *c*.300,000ha of the Dales and surrounding landscape in order to test the effectiveness of the identification of archaeological features from aerial photographs in upland areas (Horne & MacLeod 1995). The primary sources of aerial photographs utilized by the project included the RCHME, YDNPA and North Yorkshire County Council collections, with images transcribed by hand onto OS quarter-sheet translucent overlays at a scale of 1:10,560. Alongside transcription, a morphological method (MORPH2) of recording sites that did not lend themselves to functional classifications was developed, incorporating standardised descriptive and dimensional terms; this data has since been incorporated into the HER database. Given that the accuracy of the archaeological transcriptions depend on the quality of the aerial photographs and OS base maps in addition to the skill of the interpreter, it was noted that recorded features typically had an accuracy of 5-15m in intake areas, while those in moorland areas could have a positional error of up to *c*.100m (though relative position within a locale was less than this) (Horne & MacLeod 2004: 16). It was observed that the wide distribution of earthworks, and limited identification of cropmarks, could be attributed to the absence of arable farming over most of the Dales, while the detection of comparatively sparse earthworks on high moorland was interpreted as the result of the unviability of settlement and most agriculture, rather than the camouflaging effect of peat and heather cover alone (Horne & MacLeod 2004: 18). The "value and accuracy" of the mapping, as well as the potential to add to the data, has been demonstrated by more intensive aerial photographic interpretation and ground survey as part of a continuing education training course (Horne & MacLeod 2001: 65-82).

For this research, the YDMP dataset was provided by English Heritage as a series of geo-tiff files containing digitized (scanned) copies of the original hand-drawn map tiles produced by the YDMP, along with a report interpreting findings (Horne & McLeod 1995). In order to get the best out of the dataset, it was then vectorized using ArcGIS and the identified features assigned to digital layers using AutoCAD Map3D in order to make the dataset more ‘approachable’ and easily handled, and the individual features more recognizable; this was done thematically, separating out ‘field boundaries and lynchets’, ‘extraction/industrial evidence’, ‘settlement’, ‘ridge and furrow’, ‘agricultural features’, ‘pastoral evidence’, ‘trackways’, ‘enclosures’, ‘buildings’ and ‘miscellaneous’, a categorization derived from a combination of the YDMP key, morphological detail and comparison with the modern map (fig. 3.2). Beyond the use of this data to locate the principal coaxial systems, as identified in the report (Horne & MacLeod 1995: table 4.1.1.6), it has also been useful in the mapping of individual boundaries as well as in identifying features/landscapes that may overlie or conceal prehistoric field systems. It should be noted that the categorization relies on thematic rather than chronological classifications.

Fig. 3.2 Examples of Yorkshire Dales Mapping Project data. Left: a ‘raw’ sample from Swaledale. Right: a ‘cleaned’ sample from Littondale; grid lines and text were removed from the original; the following conventions are relevant to this example: dark green = lynchets/boundaries; light green dashed = ridge and furrow; brown dashed = tracks; grey = extraction industry; dark brown = buildings; orange = cairns.

3.1.4 Lidar

The power of lidar as a visualization tool in the context of similar geographical circumstances to the Yorkshire Dales has been highlighted by its use in the Ribble Valley, as part of a project that not only investigated the landscape but also evaluated the methodologies employed (Cook *et al*. 2008), and by the National Archaeological Identification Survey Upland Pilot Project (NAIS), which found it to be a very effective and efficient means of identifying and mapping archaeological sites (Oakey *et al*. 2015: 25, 61-62). With regard to the investigation of field systems specifically, the effectiveness of lidar for the detection and identification of 'Celtic' field boundaries has also been demonstrated in the Netherlands (Kooistra & Maas 2008).

The availability of lidar data, collected in 2008-9, for a proportion of the National Park allows use to be made of an excellent resource for visualization and measurement of the landscape and its constituent features. Through a combination of accurate satellite-based locational information relating to the survey plane, and high resolution scanning of the ground (or intermediary surfaces) with laser pulses, the captured data provides an accurate surface model of the terrain. This dataset, covering roughly 80 000 ha within the National Park (*c*.46% of the Park), was sourced from the UK Environment Agency; the origin of its collection in flood monitoring and environmental asset planning programmes explains the targeting of specific areas of the landscape, namely the river valleys, which are separated by large areas that lack data. In many cases data covers the valley floor, often not quite (or only just) reaching the top of the dale side – which is frustrating, given that the coaxials often survive just above this level. The extent of the 1m resolution lidar data for the National Park is shown in fig. 3.3. A block of 25cm resolution data also exists, commissioned for a survey of the lead mining landscape, covering 3000ha of Grassington Moor (Wharfedale), while an area of 50cm resolution covers just over 3000ha on the northern side of Swaledale, although only a small proportion of one known coaxial field system is covered by the 25cm data. Digital Terrain Model (DTM) data was used, as this has already had an algorithm applied with the effect of removing reflections generated by upstanding buildings and vegetation, and showing a landscape somewhat devoid of modern ‘clutter’. The possibility that this process would also strip out archaeological field boundaries seems to be an unfounded concern.

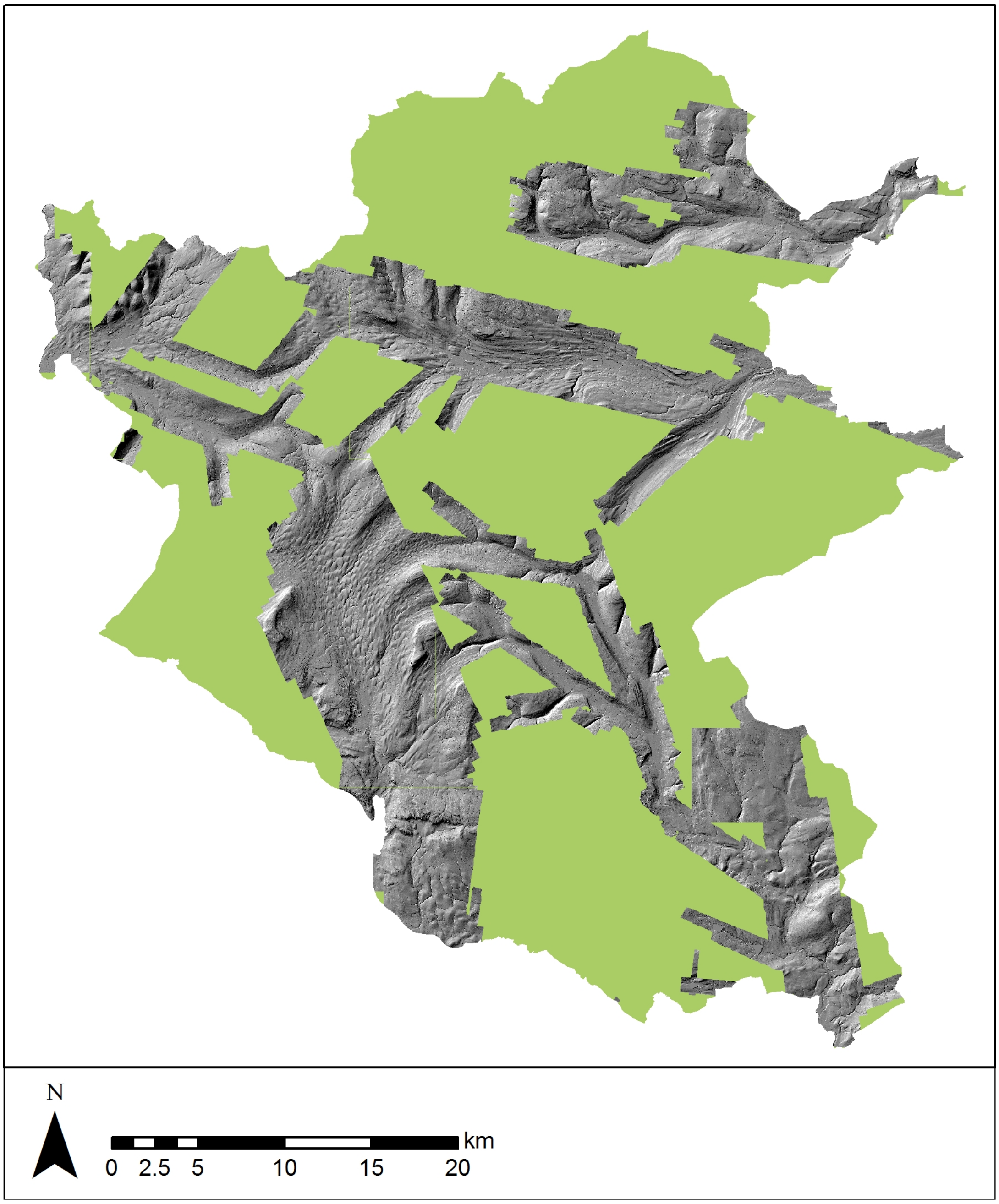


Fig. 3.3 Hillshade plot of the available lidar data for the Yorkshire Dales National Park.

The Environment Agency DTM ascii files were converted into raster images within ArcGIS (the tiles were already georeferenced). The production of hillshade images using the Arc toolbox then facilitated the mapping of individual coaxial features; hillshade plots enhance the surface representation by simulating the effect of light from a selected azimuth and angle of elevation. Given that this renders a given feature more or less visible depending on its size and orientation, as well as the parameters controlling the light source, the archaeological interpretation of a view of the same landscape from any given direction may vary considerably and care was taken to examine the systems from a number of perspectives. Experiments were made with bespoke Python code in order to combine views via a Principal Component Analysis, however the improvement to the data was felt to be negligible and in some cases it became harder to interpret; however, time allowed manual examination and comparison of the coaxial landscapes (as opposed to all the data) when lit from eight directions.

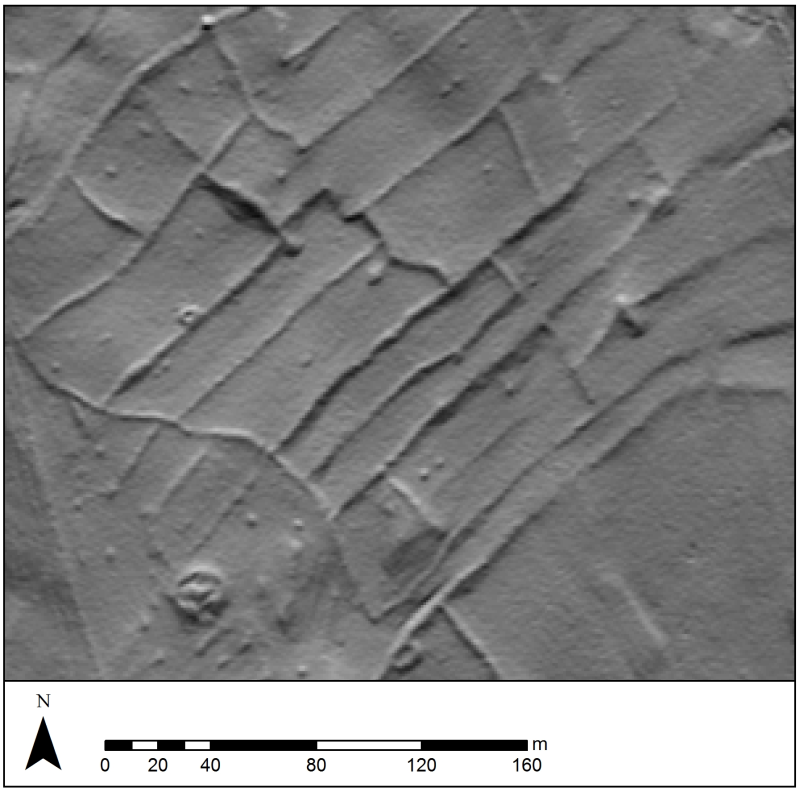


Fig. 3.4 Sample of 25cm resolution lidar data showing part of a reworked coaxial field system north of Grassington. In the bottom left corner, the remains of a burial cairn excavated by Rev. B.J. Harker in 1892/3 is visible. Evidence of shallow-shaft lead mining is also apparent.

3.1.5 Topographic data

As the available lidar data does not cover the full study area, and bearing in mind that the natural landscape is central to this research, an alternative source of topographical data was sourced through Edina Digimap, in the form of the Ordnance Survey Terrain 5 contour and DTM dataset (copyright OS 2015). This data has a root mean square error of less than 2.5m for height points in this area (Ordnance Survey 2013: 6). Although this data cannot be used for prospection, it could be used for analytical purposes through the creation of resources such as steepness plots and contour profiles.

3.1.6 Aerial photography

Given the scale of the coaxial systems, their morphology is considerably easier to comprehend when viewed from the air. Digital aerial imagery data from Bing was used as a general backdrop, proving very useful in the mapping and interpretation phases of the project, particularly in those areas that are not covered by Lidar. Bing imagery was chosen for practical reasons (*i.e.* its ease of use as a basemap layer provided by ESRI in ArcGIS) as well as for its comparatively clear images of the National Park area. There is, however, a noticeable difference in the value of this imagery between the short-cropped grassland of the limestone dales and the heather-covered gritstone moorland and bog where features were considerably less visible.

Additionally, the YDNPA holds an extensive collection of oblique and vertical aerial photographs, incorporating both images of their own copyright and those from the Cambridge University Collection of Aerial Photographs and the collection of Derek Riley. Many of these images are of superb quality and were used to add textural detail to the surface models, or to clarify interpretational issues or context, though it was not felt necessary to employ them systematically over the entire Park area due to their previous incorporation in the Yorkshire Dales Mapping Project. The HER Get Mapping digital vertical aerial photographic layer from 2008-9 was also consulted.

3.1.7 Published and unpublished plans

As noted in Section 2.2, many of the coaxial field systems in Swaledale were surveyed at 1:2000 by EDM theodolite between 1984 and 1993 as part of the Swaledale Ancient Land Boundaries Project. The original large survey plans, in the private ownership of Tim Laurie, were digitised by scanning and georeferencing to the Ordnance Survey digital 1:2500 Master Mapping layer. Use was also made of published maps of surveys in Swaledale (Laurie *et al.* 2011). Interim reports for the project are available through the website archive of the Swaledale and Arkengarthdale Archaeological Group (Fleming & Laurie 1984 - 1993).

The project also makes use of the Arthur Raistrick Collection of maps and documents held at in the University of Bradford JB Priestly Library (Special Collections), its contents having either been donated by Raistrick in the later years of his life, or by his family following his death in 1991. The collection contains around 1200 maps, relating to aspects of his geological and archaeological studies across Britain; predominantly covering the north of England, there is a marked bias towards the Yorkshire Dales. Comprising a disparate archive of field notes, annotations, hand-drawn plans (a small number of which have been published) and collected printed maps, the collection ranges from aerial survey plans with detailed additional interpretative comments, to Ordnance Survey maps with supplementary field annotations, hand drawn maps of mines and mineral veins, careful plans of archaeological features, and incomprehensible pencil scribbles on notebook pages that are now lacking confident locations. Figures 3.5 and 3.6 demonstrate representative examples of the range of plans. All suitable (*i.e.* in good condition) plans have been digitized, either by scanning or photographic means, and those that could be identified were georeferenced to the Ordnance Survey digital 1:2500 Master Mapping layer.

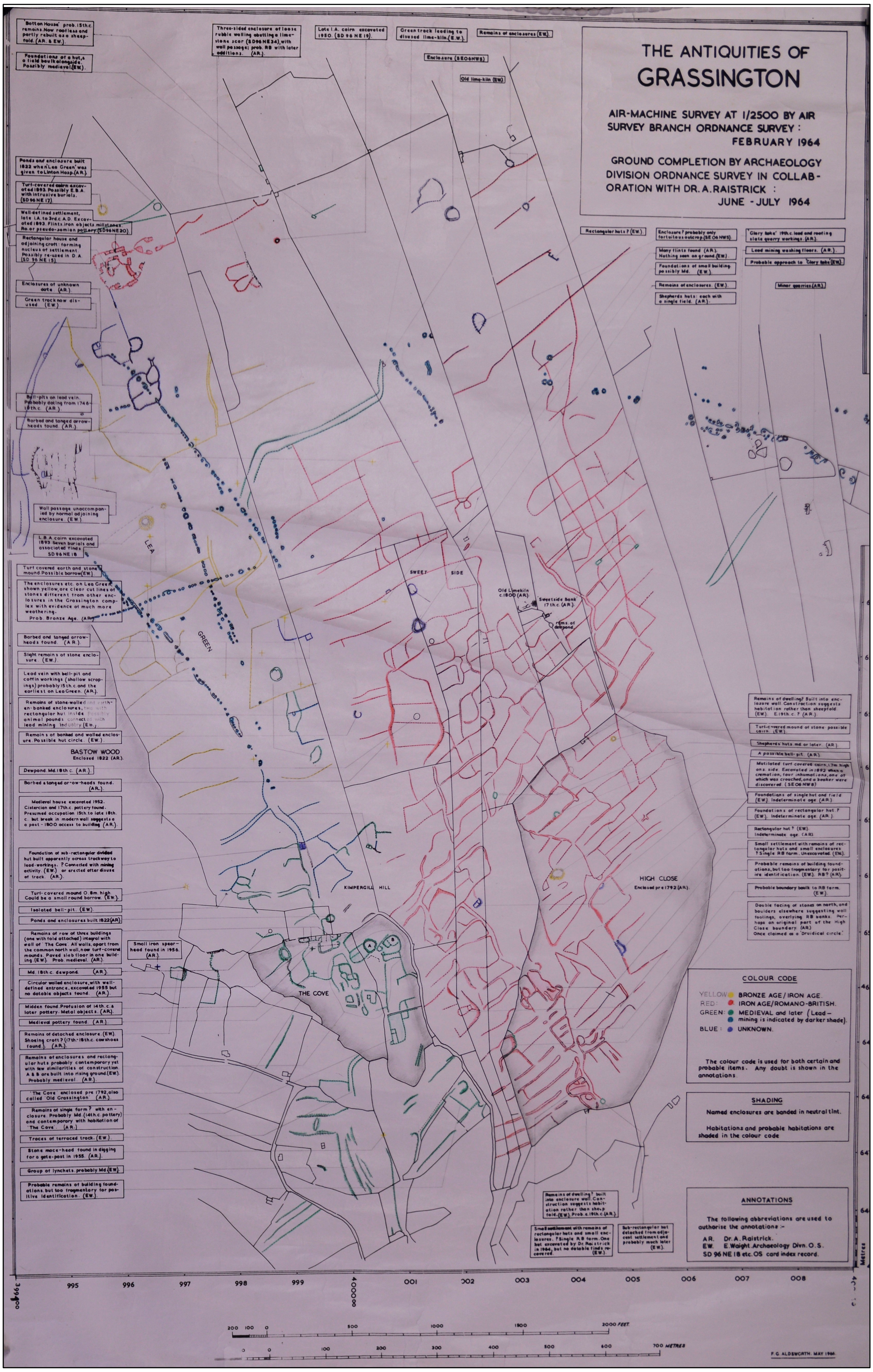


Fig. 3.5 "Air machine survey" Ordnance Survey plan of field systems on Lea Green, Grassington annotated and dates attributed by A. Raistrick and E. Waight. Yellow = Bronze/Iron Age; red = Iron Age/Romano-British; green = Medieval and later; blue = unknown. (Held in the Raistrick Collection, University of Bradford JB Priestly Library, 1373A.)

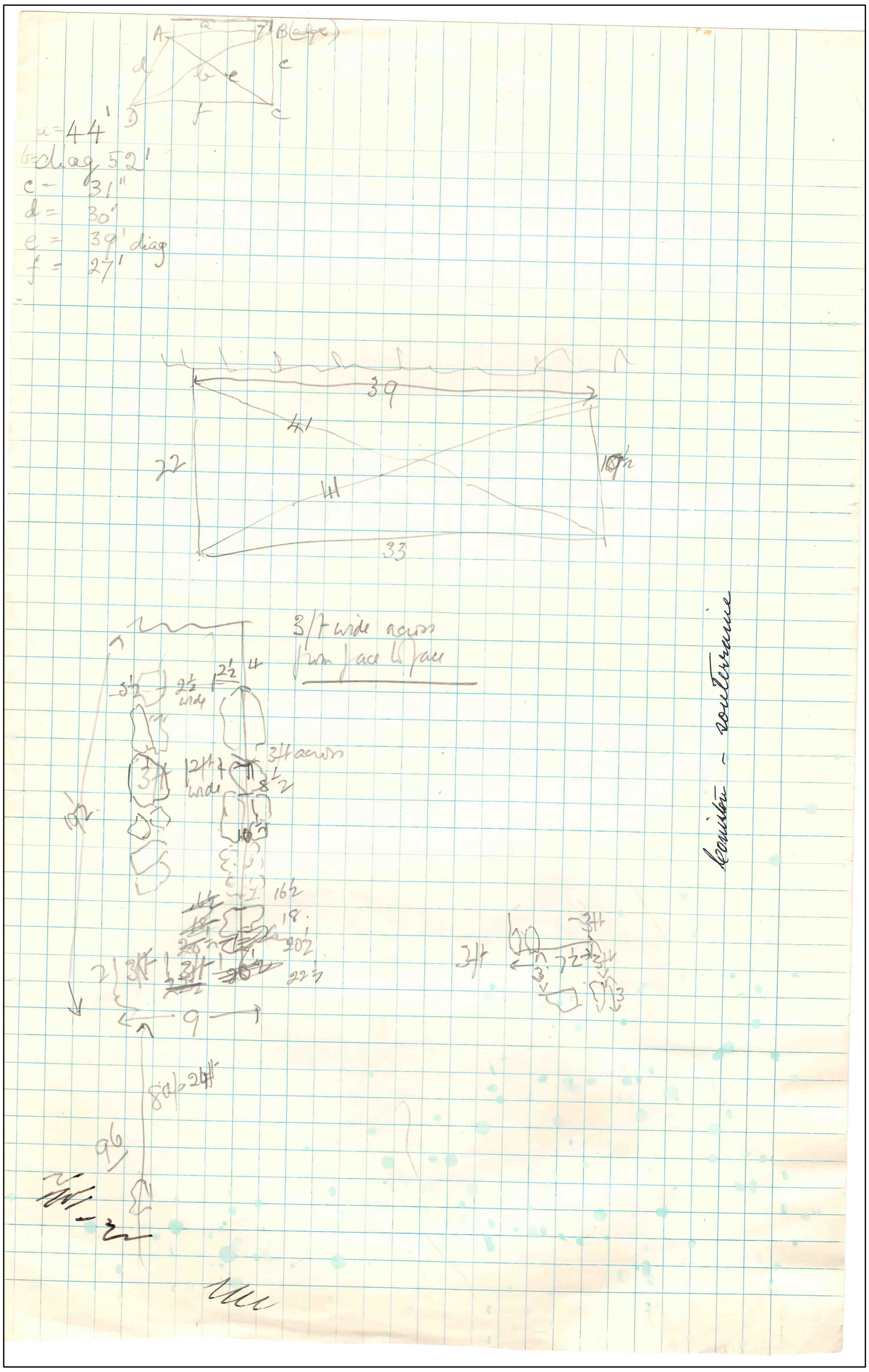


Fig. 3.6 Field plan by A. Raistrick, labelled 'Conistone - souterraine'. (Held in the Raistrick Collection, University of Bradford JB Priestly Library, 1347E.)

3.2 Method and limitations

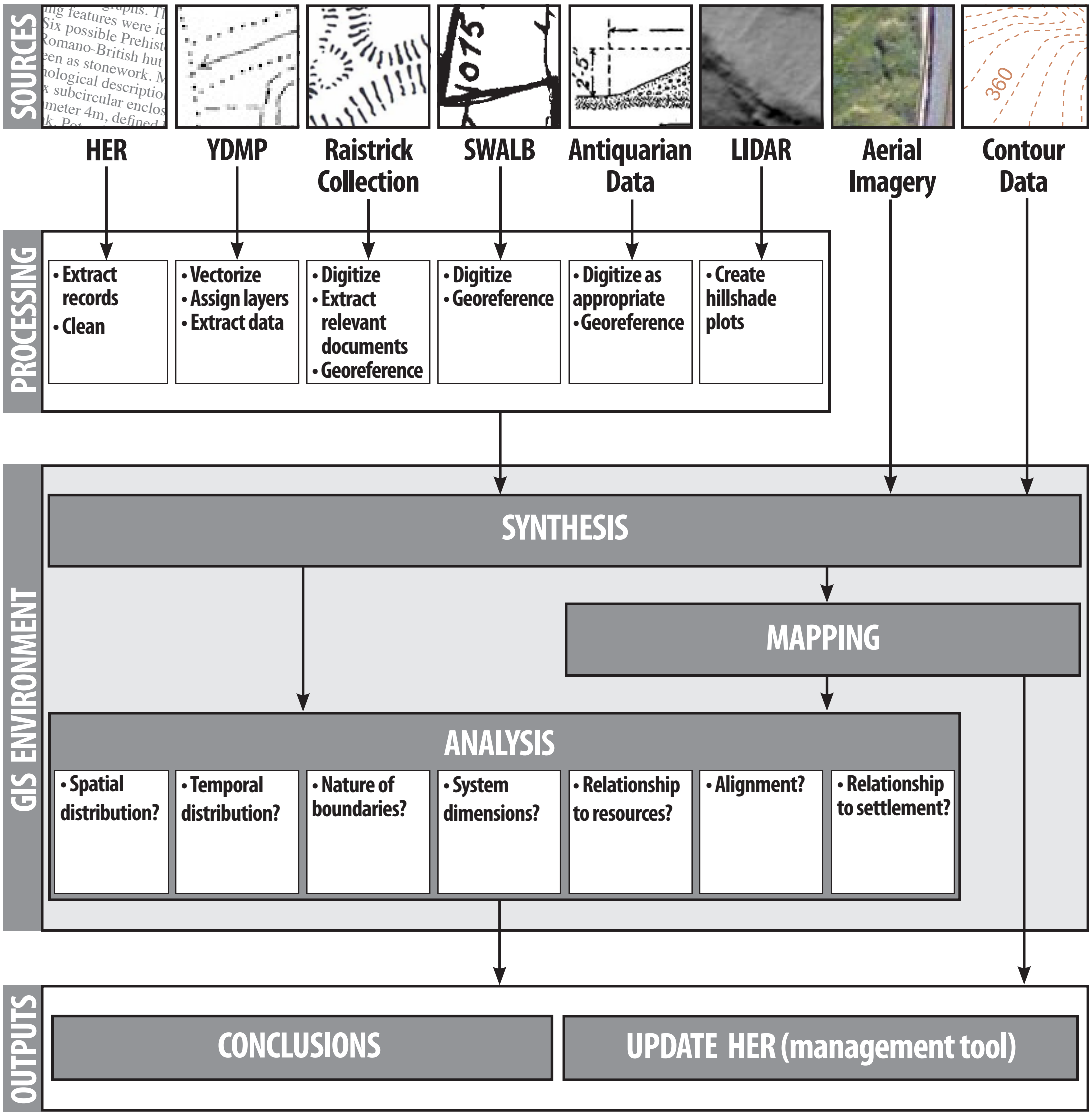


Fig. 3.7 Flow chart summarizing processes involved in this research.

The primary identification of the coaxial systems considered in this study was undertaken through the examination of the HER database records in conjunction with the YDMP report (specifically Horne & MacLeod 1995: 33-34, Table 4.1.1.6). All records identified as 'coaxial' in either source were extracted and any duplication eliminated. The categorization of 'coaxial' in either source was initially taken at face value, although on closer examination it was then broken down into 'coaxial system', that is, those systems identifiable with confidence, and 'possible coaxial system', indicating a degree of uncertainty. This uncertainty may relate to a lack of supporting evidence due to a lack of visibility on aerial imagery or on the ground, thus preventing further analysis from taking place (e.g. at Caldbergh); to the categorization having been ascribed to archaeological remains too fragmentary to be reliably referred to as coaxial (e.g. at Howgills 1 and 2, and Appletreewick); or systems that might be more appropriately categorised as 'Celtic' (e.g. at Malham 1). The details of all the coaxial and possible coaxial systems can be found in Appendices 1 and 2. Once digitized and imported into ArcGIS, the source materials were then used as a basis from which to manually interpret and map (at between approximately 1:600 and 1:1100) the visible/known coaxial boundaries. Particular use was made of the Bing aerial imagery in this respect. The digitised features and some of the source datasets (the OS Terrain-5 elevation data proved particularly versatile) were then subjected to various analyses, both manually executed and applied from the ESRI Arc toolbox. Since completion of the analyses, a GIS 'parcel' containing shape files of the mapped coaxial systems as well as auxiliary data such as lidar mosaics was lodged with the HER, and the appropriate database records created and amended.

It is acknowledged that archaeological landscapes do not always correspond neatly with administrative boundaries and while the extent of the Yorkshire Dales National Park is perhaps less arbitrary than many, echoing as it does the underlying geological block, there is no orderly cut off of field systems. Known coaxial systems in close proximity to the National Park include those of Marrick, Skelton and Ellerton Moors in mid-lower Swaledale (see Laurie *et al*. 2011), High Park in the eastern Lune Valley (Jecock 1998; Oakey *et al*. 2015) and Nidderdale to the east of the National Park (Linda Smith, pers. comm.) The presence and characteristics of these systems have been borne in mind throughout the project, but they have not been included in the analyses due to their location outside the Park. The existence of further coaxial systems that have not been recorded by the HER/YDMP has not been challenged - a degree of prospection was conducted using aerial imagery sources, however to carry this out in a systematic way over large areas would have been beyond the scope of this research.

Throughout the project, the coaxial systems are referred to by names that reflect their modern location. Although this might be seen, particularly in the case of numerical suffixes, as suggesting spatial or temporal associations where there is no evidence for any, it was felt that the benefits of ease of use outweighed this.

It must be remembered that, in view of the size of the study area, this can only be a broad approach, offering an overview of the prehistoric landscape. Moreover, it is a well noted pit-fall of the use of GIS and mapping methods that they can present evolving archaeological landscapes in a 'finished', over-complete state. Furthermore, the majority of sources used by this research are concerned with evidence visible at the level of the ground surface or above. While this may be an accurate indication of the character of the field systems in prehistory, it is highly likely that further elements existed which would perhaps influence our interpretation, but which are now either hidden from view or have been destroyed. Indeed, recent geophysical and walkover survey within the Wharfedale coaxial systems gives an indication of further complexity yet to be revealed (Mary Saunders pers. comm.).

Given that few of the coaxial systems in the Dales have received archaeological attention, and most have received none to speak of, even the most basic assessments remain to be conducted. In one sense this presents a blank canvas for interpretation, while from another perspective it highlights the fact that this investigation is still at the stage in which significant data 'gaps' potentially hinder understanding. Whereas a number of other projects on prehistoric field systems have already applied a battery of field work techniques in order to gain a fuller picture (Brück *et al.* 2005; Jones 2008; Long *et al.* 1998), the resources - financial or otherwise - do not exist at present to carry out similar campaigns in the Yorkshire Dales National Park. The synthesis and analysis produced here - the first detailed examination of many of the systems - will thus serve as a starting point for further work.

4. Anatomy of the field systems

The Yorkshire Dales was already a ‘lived in’ landscape by the late Prehistoric period, with 5% of the HER database’s *c*.32 000 records relating to pre-Roman finds and sites. Fig. 4.1 shows the distribution of these finds and sites. Evidence ranges in scale, from numerous microliths (e.g. MYD54000) to, for example, the Iron Age 'hillfort' of Ingleborough (MYD3700); in familiarity, from the well-known Neolithic remains from Victoria Cave (MYD3778), now residing in the Craven Museum, to the recently discovered hengiform monument at Threshfield (MYD57712); and in date, from Palaeolithic artefacts (e.g. MYD36672) to Romano-British enclosures (MYD1241).

The coaxial field systems, set against the backdrop of this collection of records, cannot be taken out of the context of preceding and succeeding habitation and land use. It is, after all, unlikely that the resources of the dale sides, valley floors and moors were not already exploited and possibly subject to the associated restrictions of land management when the first coaxial boundaries were constructed: modern concepts of marginality, which highlight the Yorkshire Dales’ lack of development potential or suitability for intensive agriculture, may not be an appropriate lens through which to view the prehistoric landscape. Similarly, while the boundaries stand against the backdrop of earlier land use, they have been, and remain, part of a living landscape since. This chapter presents the collated evidence for coaxial field systems within the Yorkshire Dales National Park, considering their spatial and temporal distribution and evaluating the nature and location of remains within their broader context.

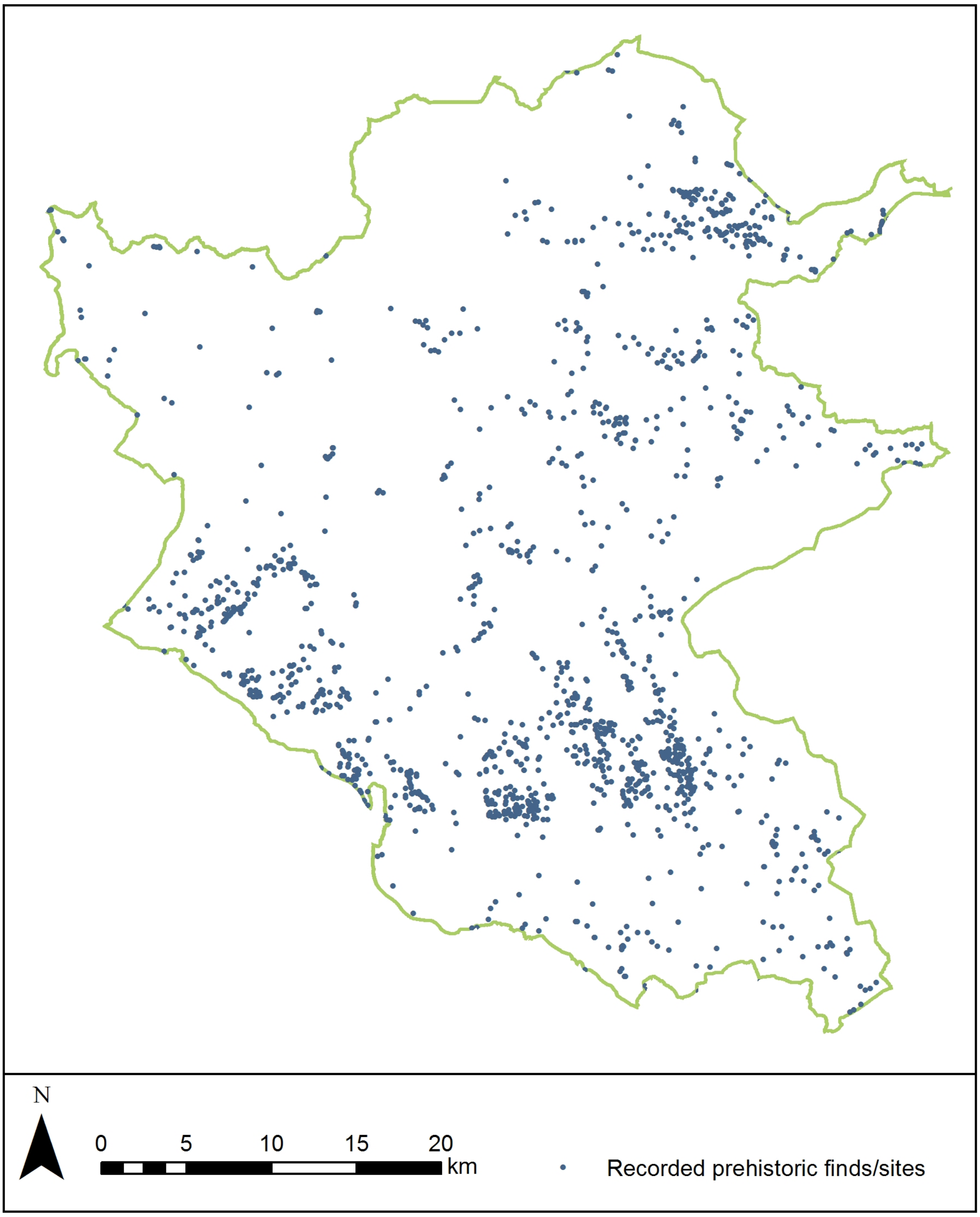


Fig. 4.1 Distribution of prehistoric sites and finds in the Yorkshire Dales National Park, as recorded in the YDNPA HER. (Source: HER)

4.1 The Coaxial Boundaries

The boundaries in these systems vary slightly, but are predominantly composed of rows of boulders deliberately positioned in alignment (it is assumed that further material has since been removed to provide walling stone), or low rubble walls that have grassed over or been covered by heather. These low rubble banks are typically between 1 and 3m in width (including tumble) and up to 0.5m high. Excavation and surface observation of coaxial boundaries in Swaledale (Fleming 2010: 140, fig. 9.1), and excavation of possible coaxial boundaries in mid-Wharfedale (Cardwell *et al.* 1990), has demonstrated some deliberately faced walls with a rubble core. Figs. 4.2 - 4.6 give an indication of the boundaries from surface observation; they are examined in more detail in Section 5.1.1.

Fig. 4.2 Axial boundary of the Grassington-Kettlewell 6 coaxial system, composed of small-medium limestone boulders. Photo: author.

Fig. 4.3 Turfed over boundaries of Grassington-Kettlewell 6 coaxial system, as seen from the air. The sheep give a sense of scale. Photo: author.

Fig. 4.4 Axial boundary of the Middlesmoor Pasture system in snow. Photo: author.

Fig. 4.5 Heather-covered axial boundary on Reeth Low Moor, Swaledale. Photo: author.

Fig. 4.6 Axial boundary of the Grinton coaxial system, running away from the camera. Note how even short heather severely reduces visibility. Photo: author.

4.2 Spatial distribution

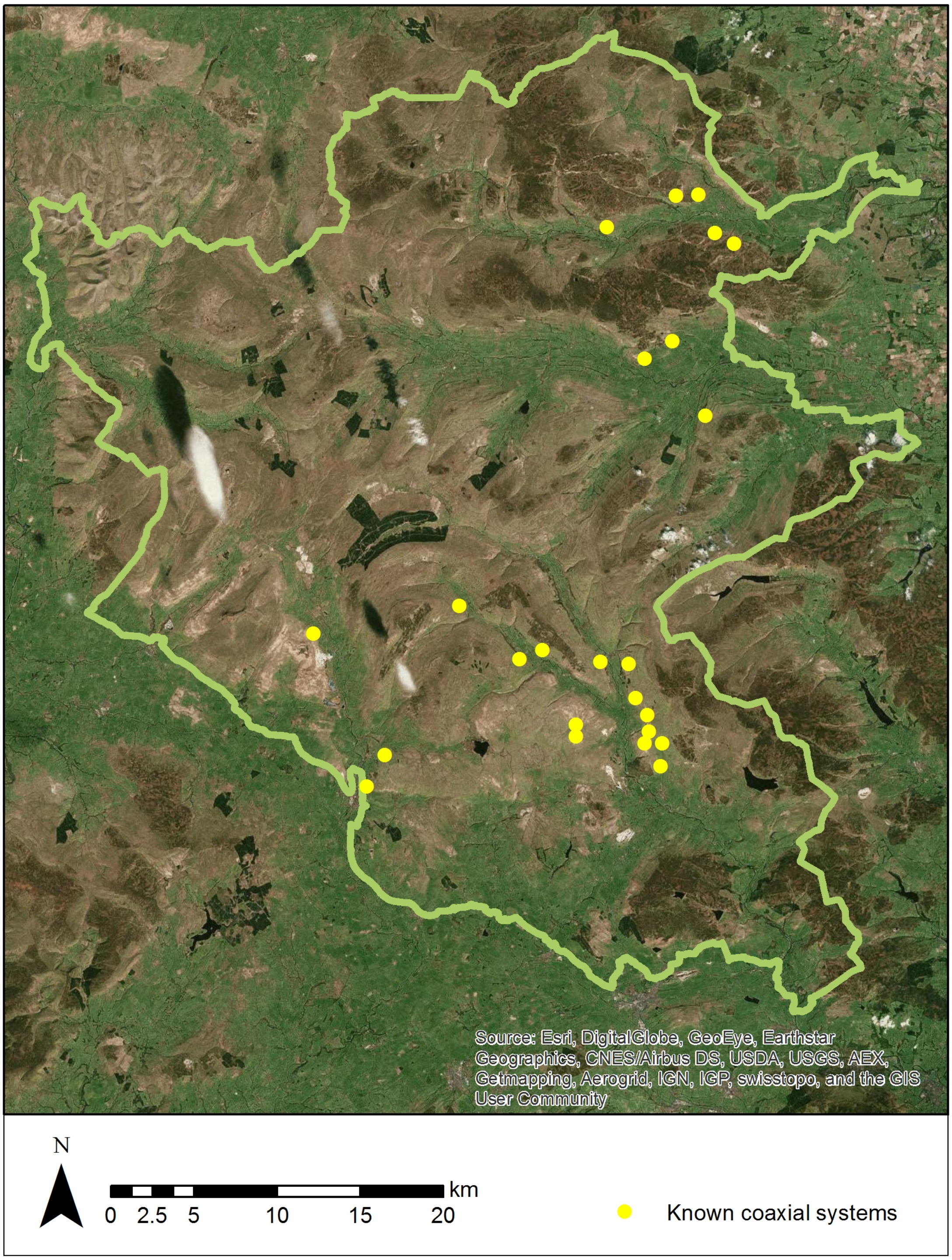


Fig. 4.7 Distribution of known coaxial field systems in the Yorkshire Dales National Park.

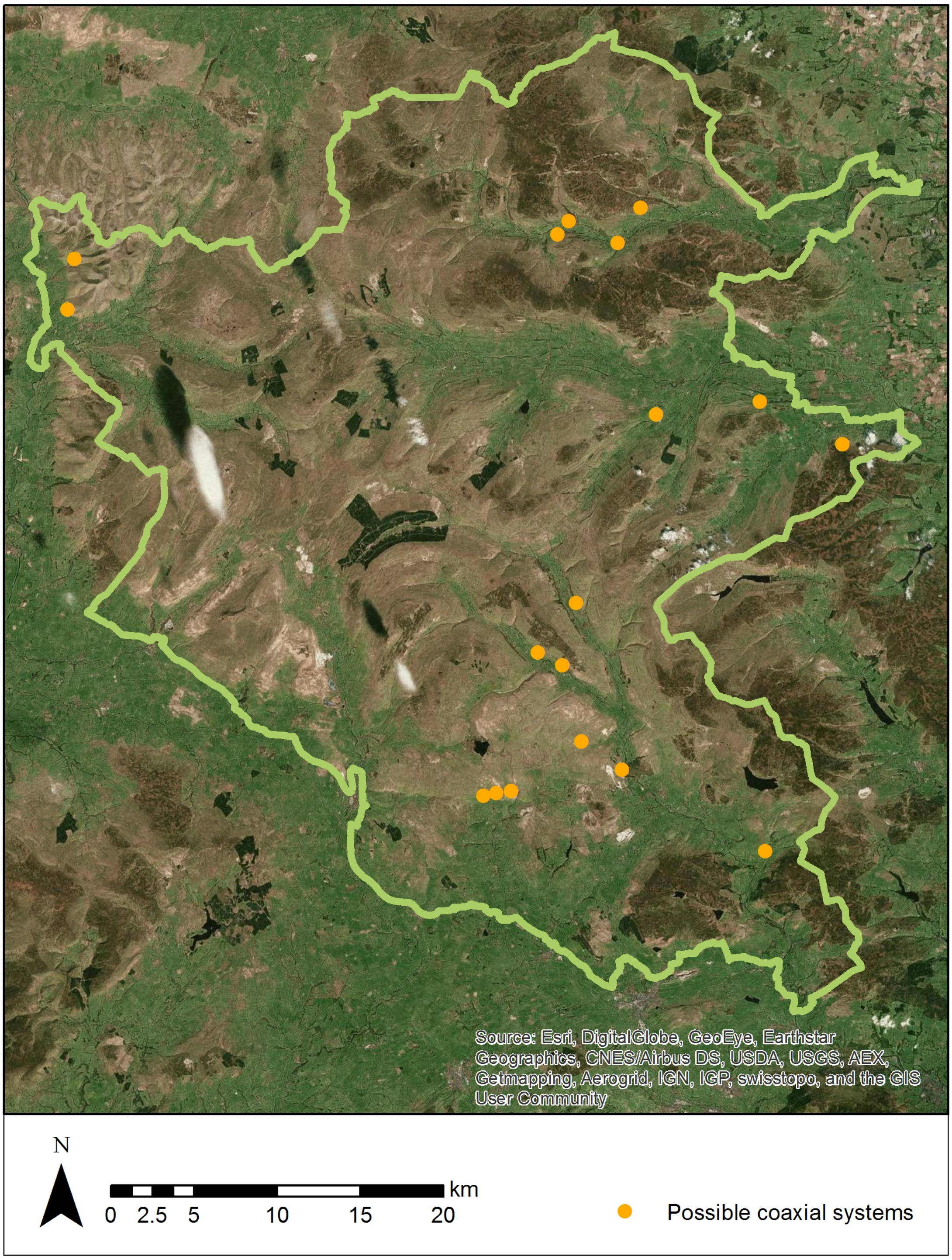


Fig. 4.8 Distribution of possible coaxial field systems in the Yorkshire Dales National Park.

The distribution of the 24 identified and 18 possible coaxial field systems is shown in figs. 4.7 and 4.8. This indicates a clear bias towards locations in the south and northeast of the National Park, with an apparent gap in the northwest quadrant that includes the upper portions of the major eastern dales as well as Garsdale and Dentdale. Nine distinct systems are identifiable in Mid-Upper Wharfedale, covering a total of at least 746ha, with three in Littondale (104ha), three in Ribblesdale (124ha), three in Mid Wensleydale (72ha) and five in Mid Swaledale (447ha), in addition to the fragments and suggestions of evidence identified here as ‘possible’ coaxial systems (as defined in the previous chapter: Section 3.2). The systems are most commonly found on the broader landscapes of the mid-valley, and on the main valley sides as opposed to those of the tributary gills (many of which are very steep and narrow).

The accuracy with which this reflects the ‘real’ or original distribution is difficult to determine - as always, issues of survival, modern land use and visibility are raised. As already discussed, limited archaeological attention has been paid to the field systems of the Dales, yet those systems that have been previously identified in Swaledale and Wharfedale have contributed to a positive spiral of interest in surveying the surrounding vicinity. A striking lack of field systems, considering its expansive size, occurs in Wensleydale, which has seen limited study and more extensive modern agricultural activity than most other areas; it is possible that more lie as yet undiscovered, although it may be because of the anomalous size and character of the dale that its hillsides were not considered appropriate or necessary for use in the same way as the narrower valleys.

On the other hand, the Cumbrian dales have a different character, stemming from their west-facing situation - they are not in the rain shadow of the Pennines - and their local topography - they have flat valley bottoms with sides that are smooth and rounded (fig. 4.9). They also have frequent consequent streams and tributary gills, which run reasonably directly from the upper hillsides to the valley, giving the impression that the valley sides are folded or incised. It is tempting to suggest that these may have served as natural boundaries, rendering the stone walls of the dry limestone country unnecessary. A noticeable difference exists between the land ownership of farms in valleys such as Littondale, where habitation is clustered in hamlets and land parcels are spread around the local area (in order to share resources), and valleys such as Dentdale, where farms are distributed

Fig. 4.9 View down Deepdale into Dentdale illustrating the contrasting topography. The majority of the lines of trees mark the lines of small consequent streams, most of which begin higher up the fellside. The strident lines of the enclosure boundaries (just discernable here) on the upper fellside echo the earlier pattern of coaxial boundaries elsewhere.

regularly along the valley at the same elevation and land is divided into associated strips incorporating a share of resources from the different zones of the valley side (Miles Johnson, pers. comm.). This division corresponds to that between western and eastern dales and while it may be unwarranted to suggest that these strips are the remnants of early coaxial systems, the situation nevertheless points at a different tradition of later land use between the Cumbrian dales and those demonstrating the remains of prehistoric coaxial field systems, that might explain the lacunae of coaxial evidence.

Similar issues also apply to the distribution of the field systems at the local level, within individual dales. In the quintessential glaciated valleys of Wharfedale, Littondale, Wensleydale, Swaledale and Ribblesdale, the majority of systems survive on the upper slopes of the dale-side, above the alluvium and more intensive use of the valley floor but below the high moorland. The assumption is therefore that the lower reaches of the early systems have been truncated by medieval and post medieval agriculture - for which there is extensive surviving evidence - while the upper range may be obscured by heather, bog and peat cutting (Miles Johnson, pers. comm.).

In general, where field systems have survived, preservation is relatively good - and in some cases excellent - although they have inevitably suffered from the robbing of stone to build the later drystone walls that are ubiquitous in this region. Particular difficulties lie in determining the area and dimensions of the systems, as well as any internal detail, given the challenges presented by ground cover such as heather and longer grass.

Fig. 4.1 illustrates the distribution of the 1459 prehistoric sites and finds in the Yorkshire Dales National Park, known from the HER. As shown in fig. 4.10, it is noticeable that the distribution of coaxial systems closely echoes the areas of higher densities of prehistoric finds and sites (according to the HER database). This distribution of finds is likely to be a product of the differing intensity of archaeological attention that has been paid to various localities, with Mid Swaledale, Ingleborough and Upper Wharfedale being the foci of work by particularly active local archaeological groups and Malham of a University of Bradford research project (Donahue *et al.* 2002). If this is correct, it follows that there are likely to be further coaxial systems currently lying unrecognized in less closely scrutinized areas of the national park, although it is possible that an expectation that extensive tracts of fields originally existed owes more to a modern familiarity with a largely field-based landscape.

A significant number of the 1459 sites and finds - at least 38% - relate to agricultural features. Although the nature of features of this type, which often have few associated dateable artefacts and a presumed long lifespan, makes them difficult to date precisely, most have been dated on morphological grounds to the prehistoric period. The HER records range in content from the specific, such as ‘plough marks’, through field systems of various types, to the more numerously populated, broader and possibly less rigorously applied categories of 'field boundaries' and 'enclosures'. Fig. 4.11 illustrates the distribution of these ‘field boundaries’ (other than those

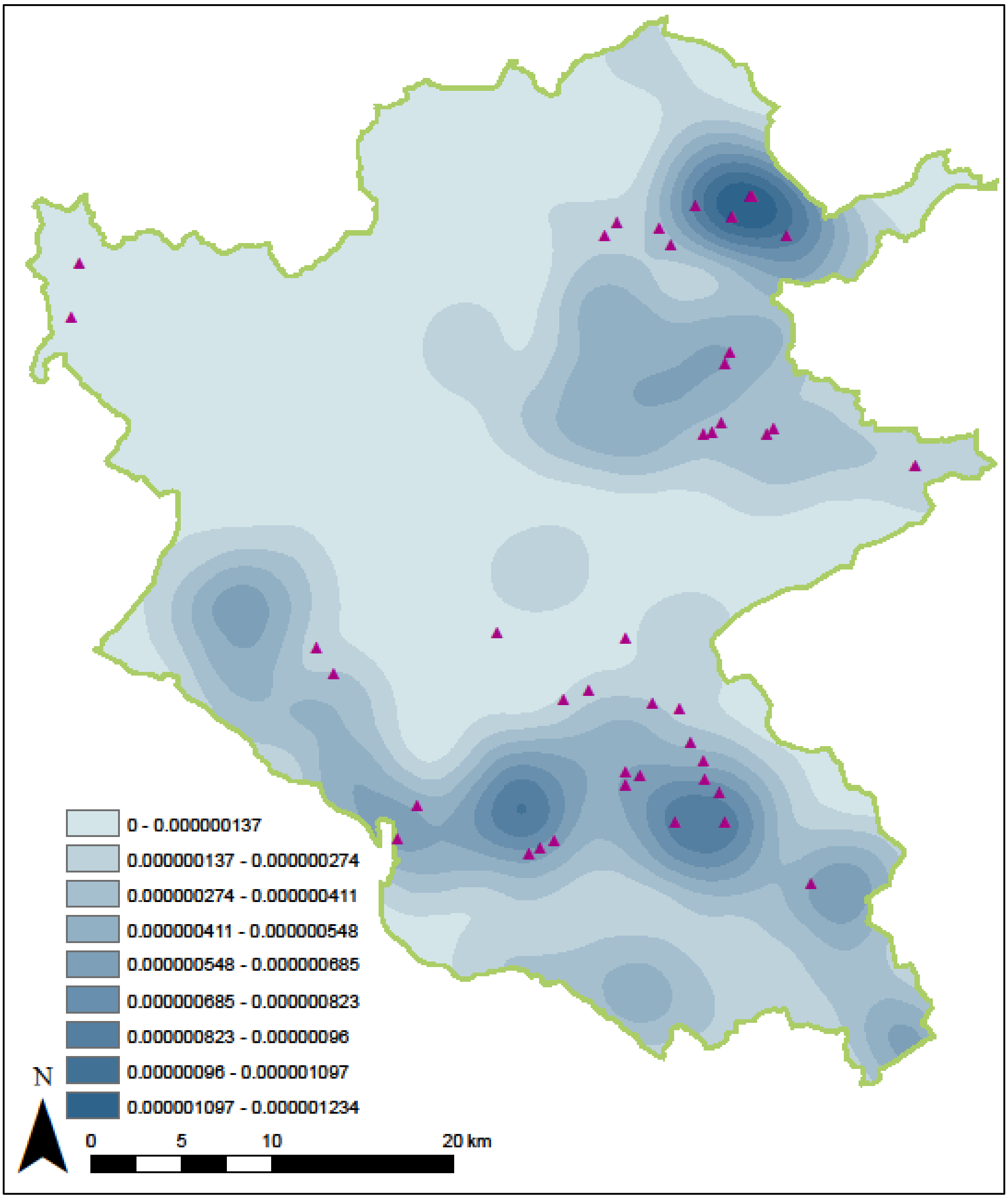


Fig. 4.10 Location of known and possible field systems (purple triangles) in relation to the distribution of prehistoric sites and finds (derived from HER data) plotted as a kernal density surface. The highest densities of finds are located around mid Swaledale (in the northeast of the national park), Malham (in the south) and mid-upper Wharfedale (southeast). The kernal density scale shows the number of sites/finds per square metre.

associated with coherent field systems) and 'enclosures'. Very little direct evidence for arable agriculture exists, the exception being two instances of plough marks (although this will have more to do with the discovery rate of subsurface features than their true frequency) as shown in fig. 4.12, which shows the distribution of 'plough marks' and 'farmsteads'. Fig. 4.13

demonstrates the distribution of known field systems, breaking them down into those categorized as 'coaxial', 'possible coaxial', ''Celtic' fields', 'cairnfields' and 'undifferentiated' field systems (including small irregular plots and those associated with settlement). The overall distribution visible in fig. 4.1 is echoed in these figures, and it is again likely that the activities of particularly committed local archaeology groups have influenced this.

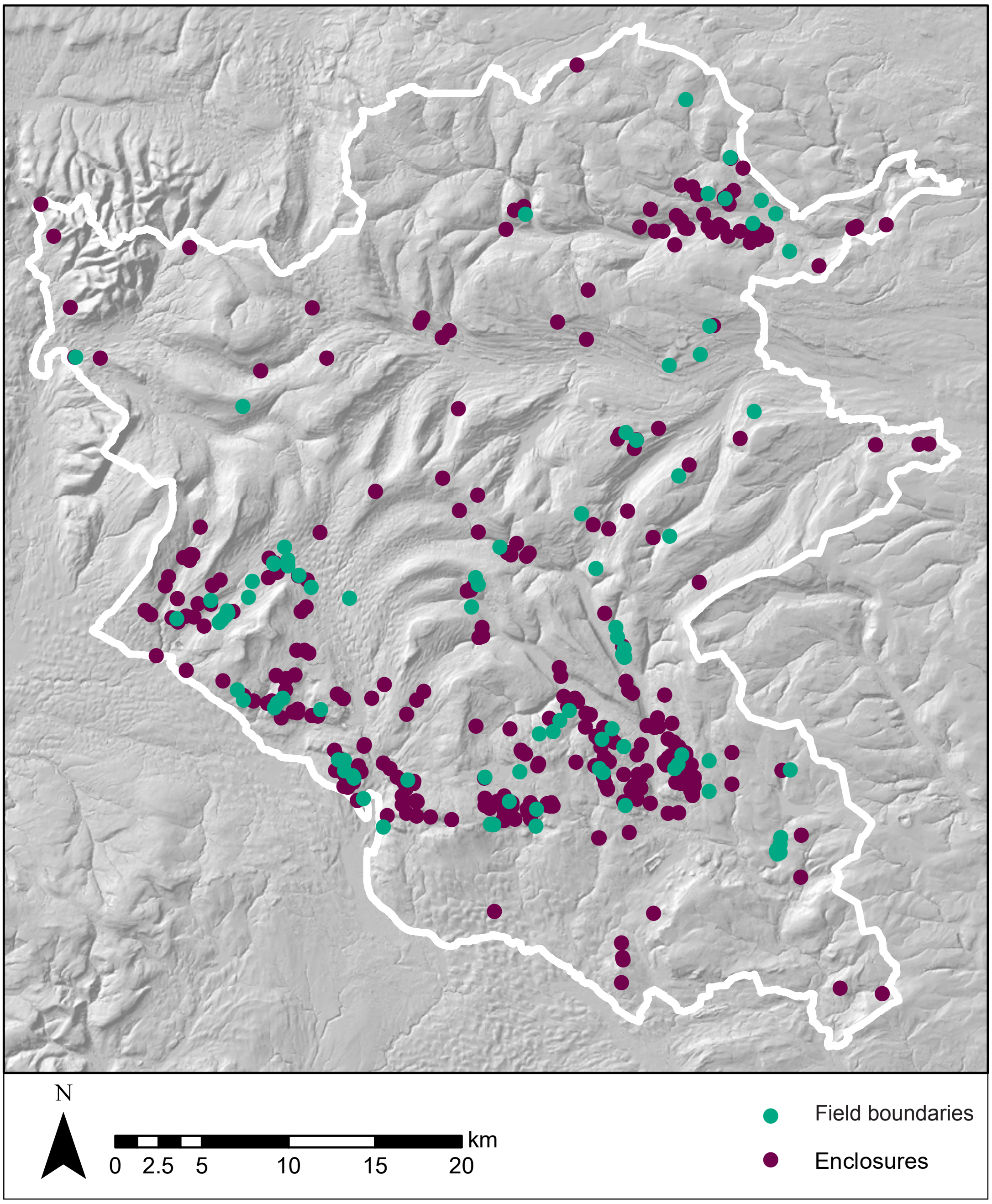


Fig. 4.11 Distribution of sites recorded as field boundaries and enclosures in the Yorkshire Dales National Park. (Source: HER. Background mapping derived from Ordnance Survey Terrain 5 elevation data 2015.)

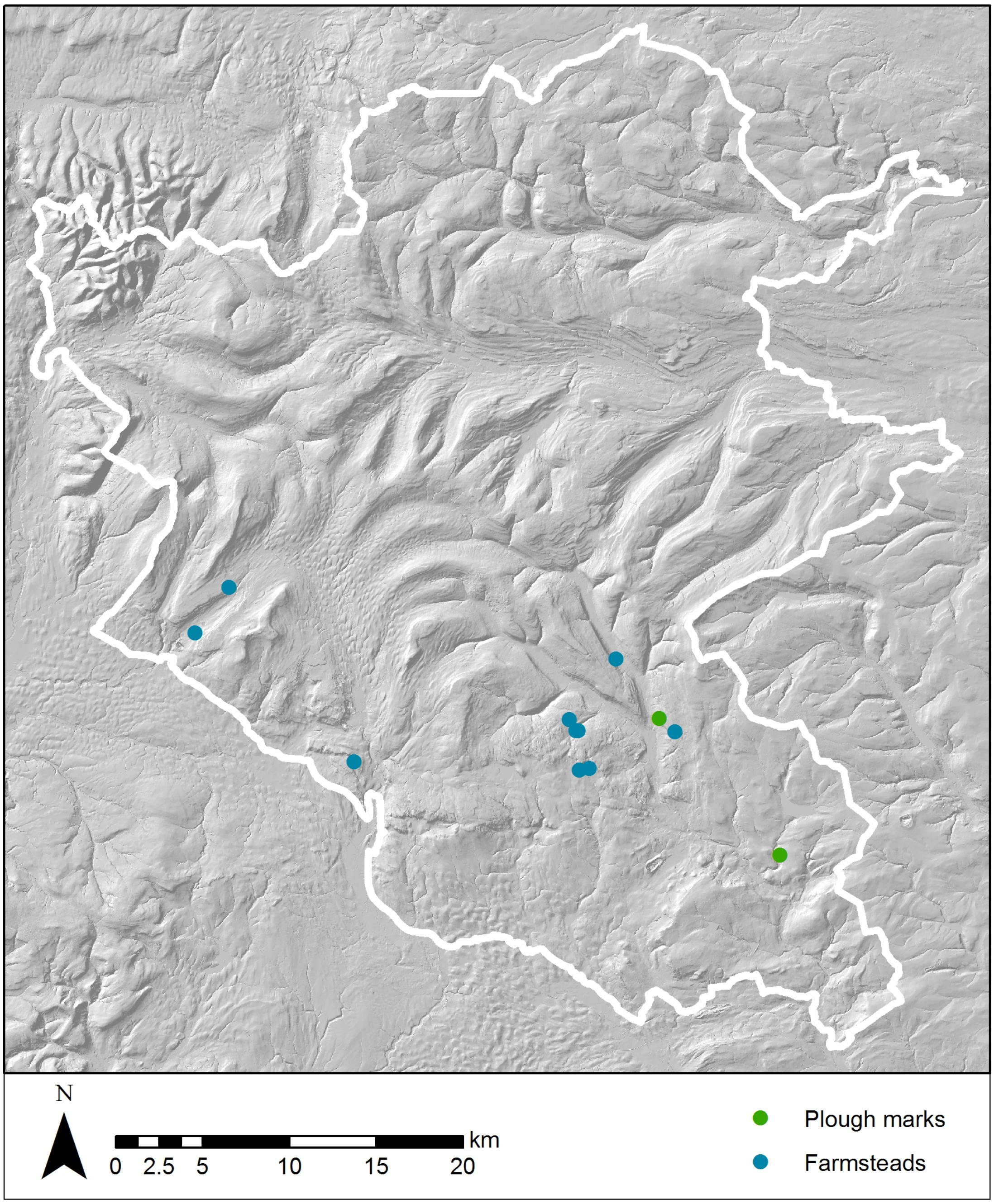


Fig. 4.12 Distribution of features recorded as plough marks and sites recorded as farmsteads in the Yorkshire Dales National Park. (Source: HER. Background mapping derived from Ordnance Survey Terrain 5 elevation data 2015.)

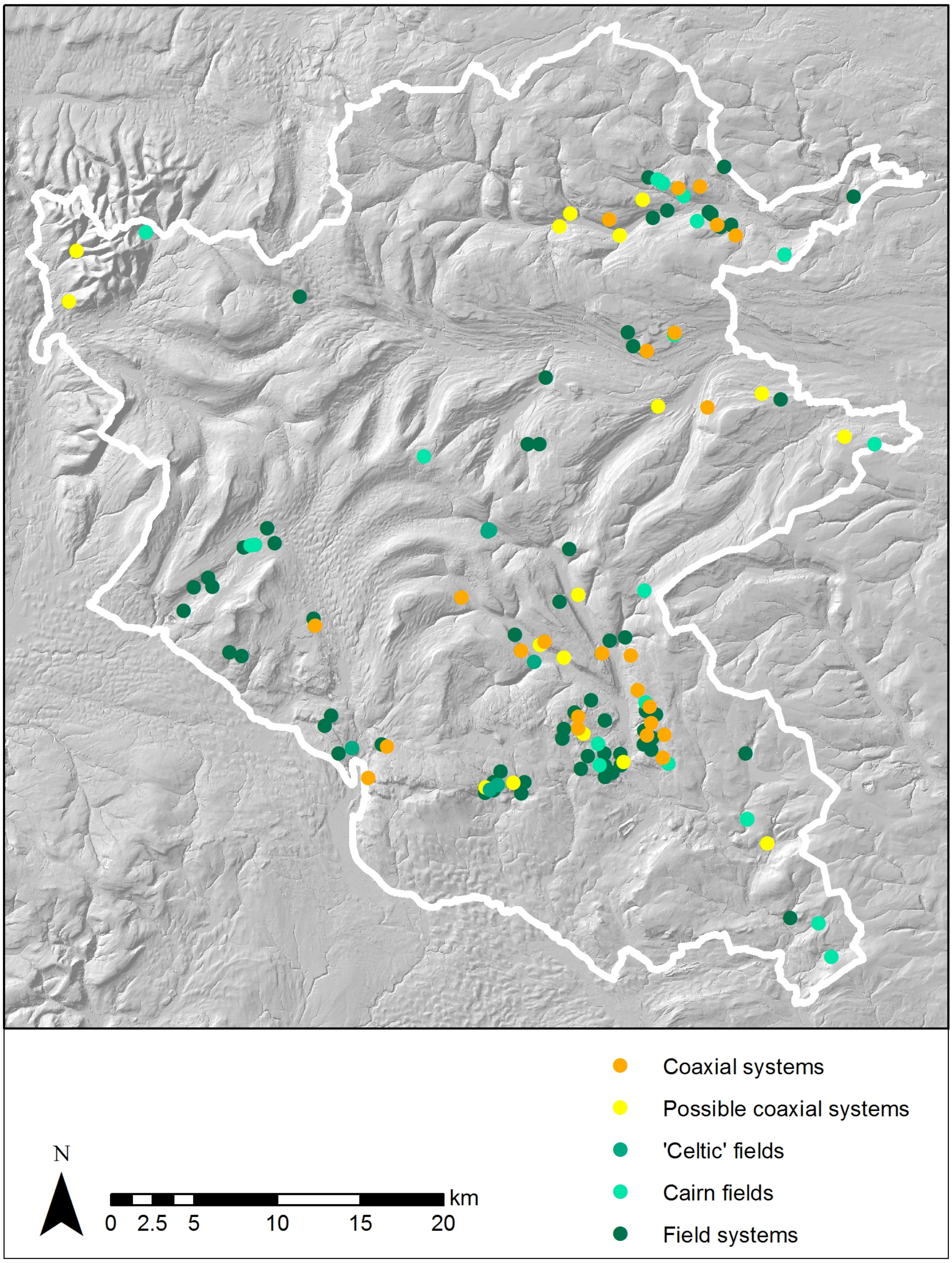
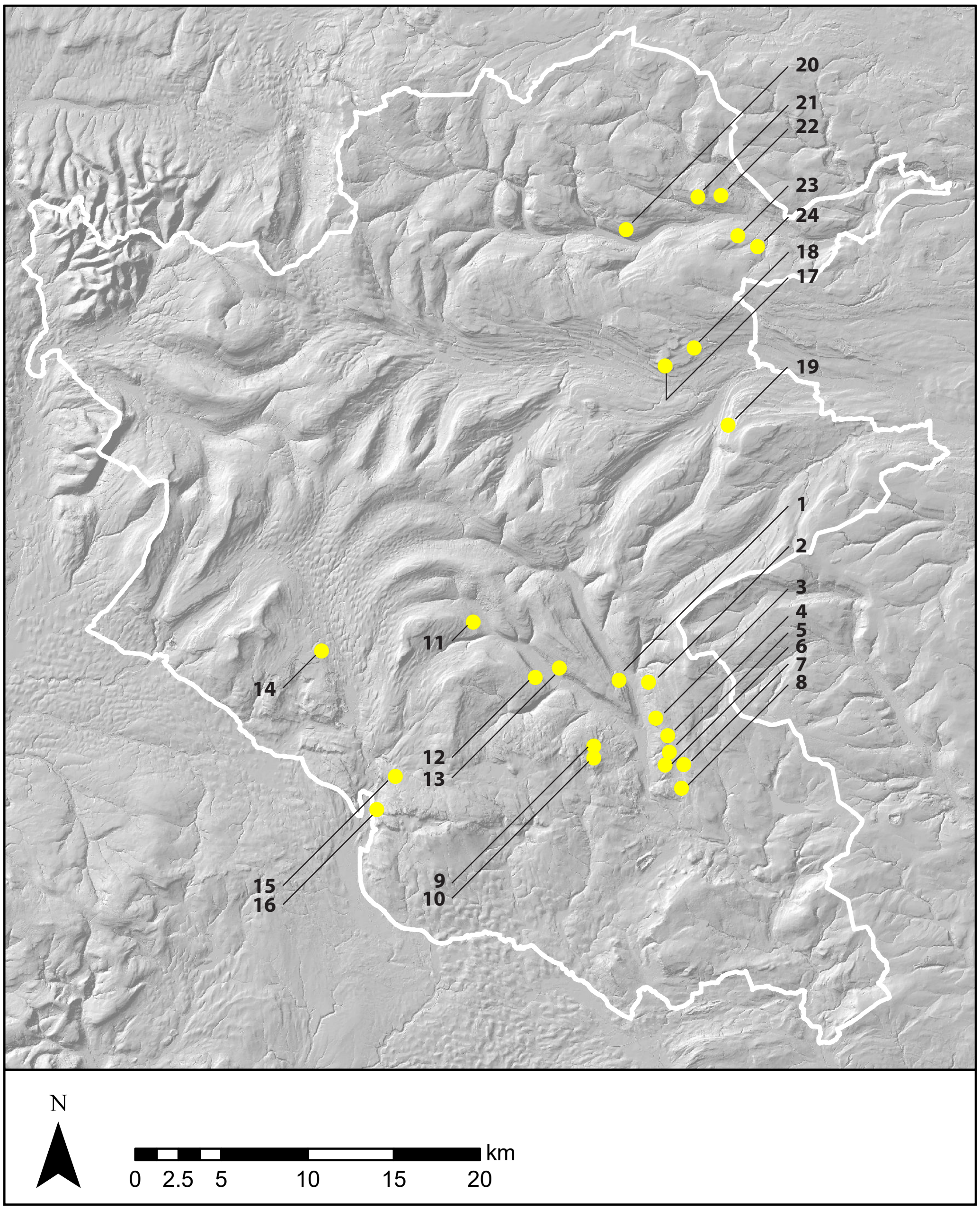


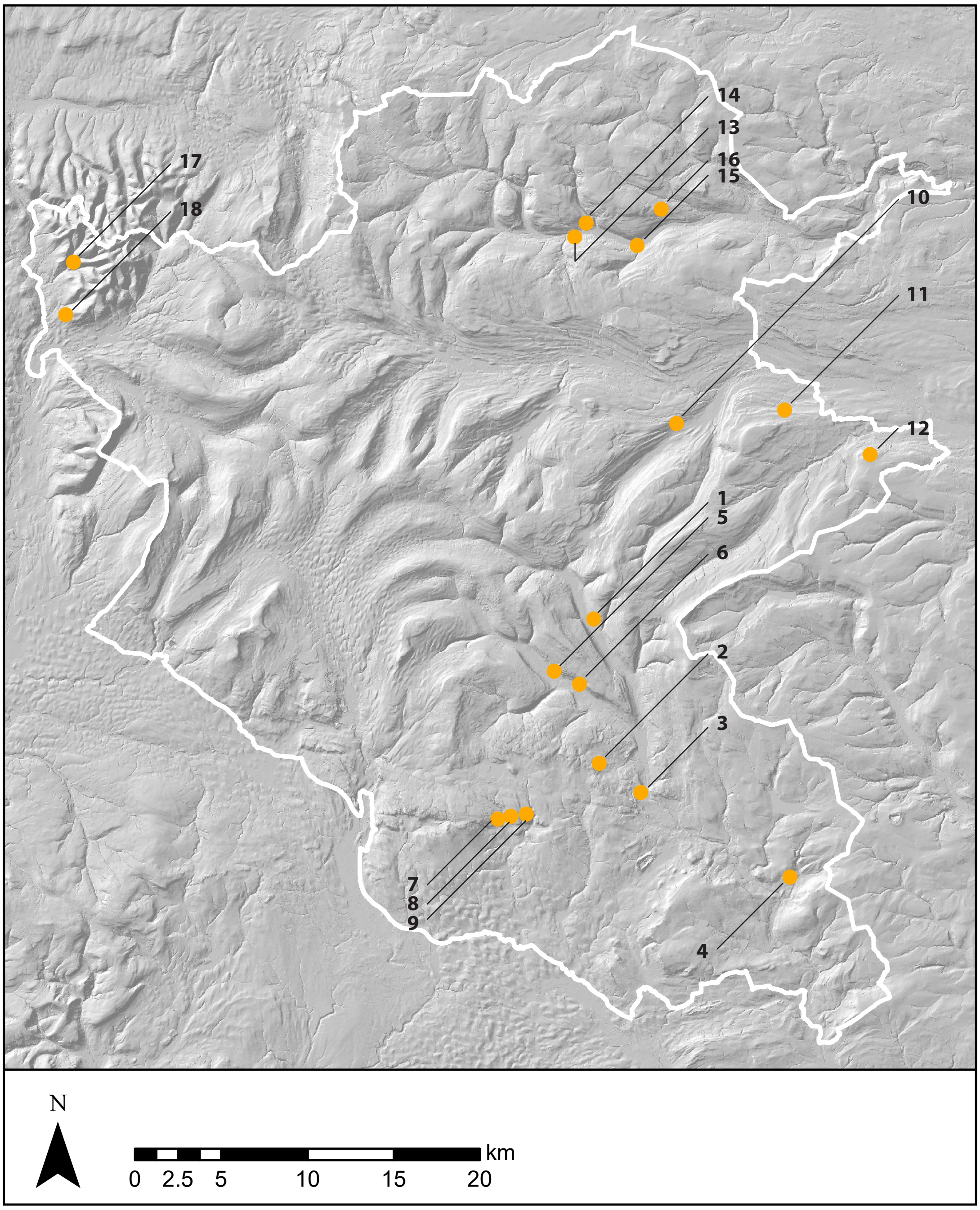
Fig. 4.13 Distribution of sites recorded as prehistoric field systems in the Yorkshire Dales National Park. (Source: HER. Background mapping derived from Ordnance Survey Terrain 5 elevation data 2015.)

4.3 The systems



1 Middlesmoor Pasture
2 Grassington-Kettlewell 1
3 Grassington-Kettlewell 2
4 Grassington-Kettlewell 3
5 Grassington-Kettlewell 4
6 Grassington-Kettlewell 4a
7 Grassington-Kettlewell 5
8 Grassington-Kettlewell 6
9 Kilnsey 1
10 Kilnsey 2
11 Halton Gill
12 Cowside Beck
13 Arncliffe
14 Horton
15 Stainforth
16 Settle
17 Carperby 1
18 Carperby 2
19 West Burton
20 Low Row Pasture
21 Healaugh
22 Reeth
23 Harkerside
24 Grinton Moor

Fig. 4.14. The 24 coaxial systems categorized as 'known' in this study.



1 Starbotton
2 Kilnsey 3
3 Chapel House Wood
4 Appletreewick
5 Flats Barn
6 Hawkswick
7 Malham 1
8 Malham 2
9 Malham 3
10 Thoralby
11 West Witton
12 Caldbergh
13 Satronside
14 Gunnerside
15 Crackpot
16 Featham Pasture
17 Howgills 1
18 Howgills 2

Fig. 4.15 The 18 coaxial systems categorized as 'possible' in this study

The coaxial systems are considered in this chapter by catchment area, travelling down each individual valley as per fig. 4.16.

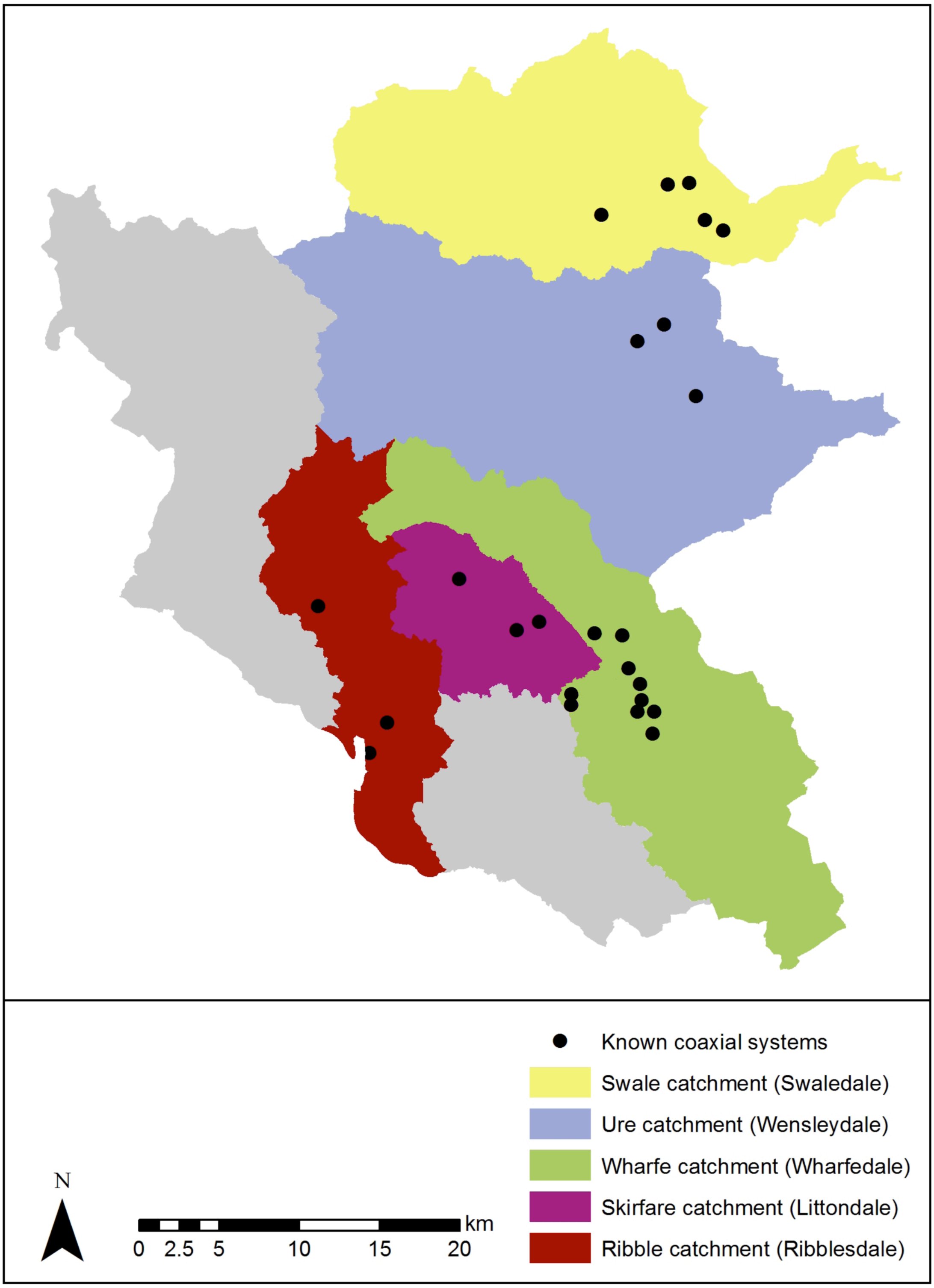


Fig. 4.16. Map of coaxial systems in relation to major catchment areas within the Yorkshire Dales National Park.

Table 4.1 Dimensions of known coaxial field systems in the Yorkshire Dales National Park (as mapped in the GIS).

System	Area (ha)	Width (m)*	Length (m)**	Total length of boundaries (m)	Min. elevation (m aOD)	Max. elevation (m aOD)
Middlesmoor Pasture	39	1170	410	1423	295	420
Grassington -Kettlewell 1	102	2000	850	3708	285	440
Grassington -Kettlewell 2	92	1800	820	5884	305	415
Grassington - Kettlewell 3	64	660	2170	4808	320	385 (490***)
Grassington - Kettlewell 4	66	1000	1120	7783	305	370
Grassington - Kettlewell 4a	92	1180	1020	2719	225	330
Grassington - Kettlewell 5	53	1560	740	6099	240	365
Grassington - Kettlewell 6	156	1900	1500	23 805	220	345
Kilnsey 1	19	400	780	1590	365	455
Kilnsey 2	86	720	1050	2078	345	465
Halton Gill	38	1730	410	2980	325	405
Cowside Beck	48	850	700	2228	335	435
Arncliffe	17	440	520	1348	285	390
Horton	49	850	700	2173	265	360

Stainforth	38	430	860	3160	290	370
Settle	63	1300	600	5207	190	370
Carperby 1	17	570	410	922	280	350
Carperby 2	9	1240	540	2284	290	330
West Burton	31	975	450	2018	315	390
Low Row Pasture	6	440	180	479	375	390
Healaugh	141	2970	590	10 227	320	425
Reeth	102	1500	930	7 855	265	415
Harkerside	86	2250	650	13058	205	390
Grinton Moor	104	1600	900	9326	240	410

** Along valley side ** Back from the 'shoulder' of the valley side*

**** Elevation of one exceptionally long boundary (see Section 4.6)*

In Sections 4.4 to 4.8, location maps, aerial views providing geographical context and plots of local topography with known archaeological context have been generated. They are the product of manual mapping of coaxial features from the various datasets combined in the GIS. The illustrations utilize the following background data:

• The background mapping for the location maps is provided by OS MasterMap® Topography Layer 1:1000 EDINA Digimap Ordnance Survey Service.

• The background aerial view for the geographical context maps is provided by ESRI as a base mapping layer (see credit on maps).

• The background contour data for the HER context maps is provided by OS Terrain® 5 [ASC geospatial data], Scale 1:10000 EDINA Digimap Ordnance Survey Service. Additional data from the YDNPA HER.

4.4 The Wharfedale Systems

4.4.1 Wharfedale

Wharfedale runs northwest-southeast through the limestone of the southern part of the National Park. North of Kilnsey, Littondale branches off to the west of the main dale, but a generally small number of tributary valleys means that the main valley retains its classic glaciated U-shape. The flat valley floor is largely used as improved pasture, with rough grazing on the high ground, much of which has a stepped profile due to the differential erosion of the horizontal geological bedding. In many places the valley sides are wooded due to the extreme gradient. Archaeologically, Wharfedale demonstrates a broad occupational history, with elements ranging from Neolithic henges to recent industrial (lead mining) remains contributing to the modern landscape.

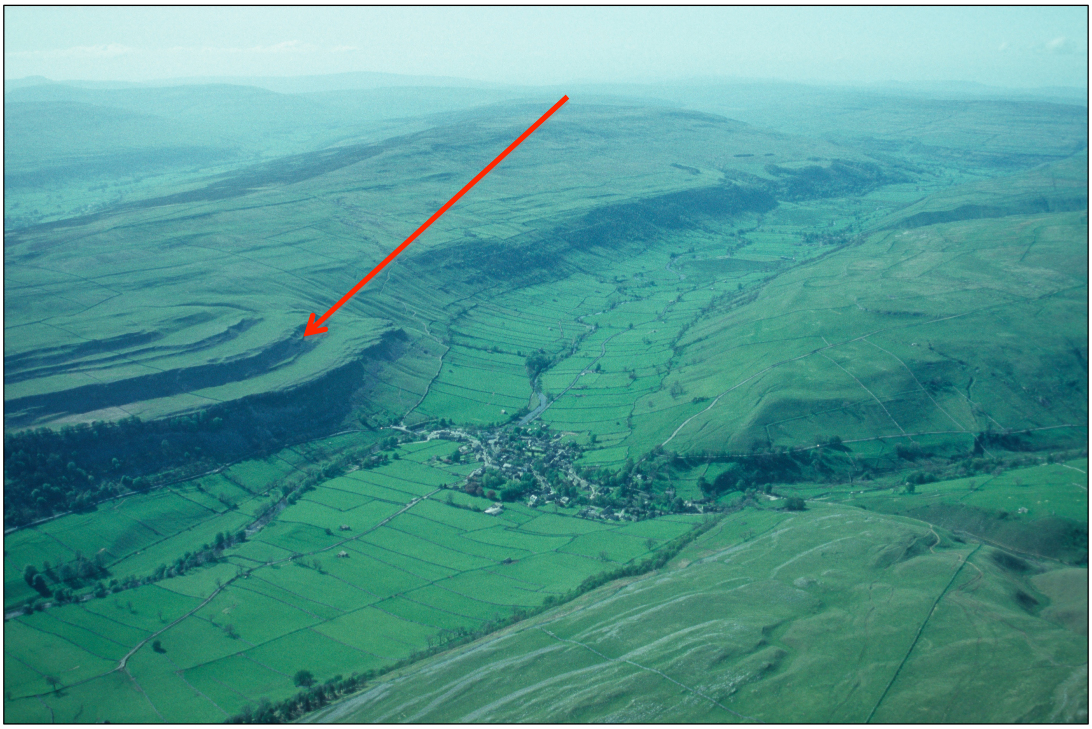


Fig. 4.17 Aerial view of Upper Wharfedale and Kettlewell looking northwest. Knipe Hill is located on the left of the frame, with the conspicuous terraces of the lower portion of Middlesmoor pasture indicated by the arrow. Photo: YDNPA YDP078-15.

4.4.2 Middlesmoor Pasture

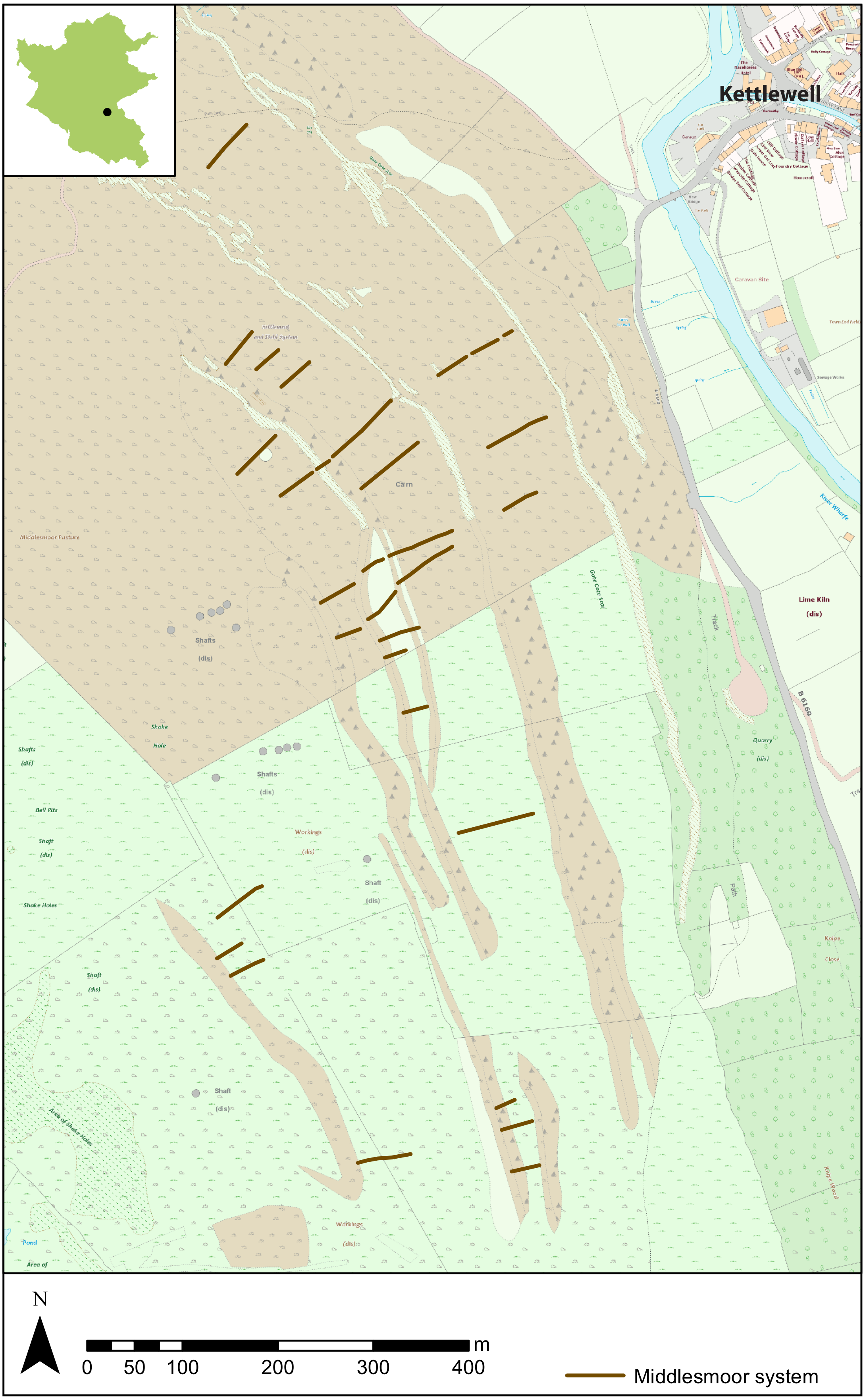


Fig. 4.18 Location of Middlesmoor Pasture coaxial system.

Fig. 4.19 Middlesmoor Pasture coaxial boundaries in geographical context.

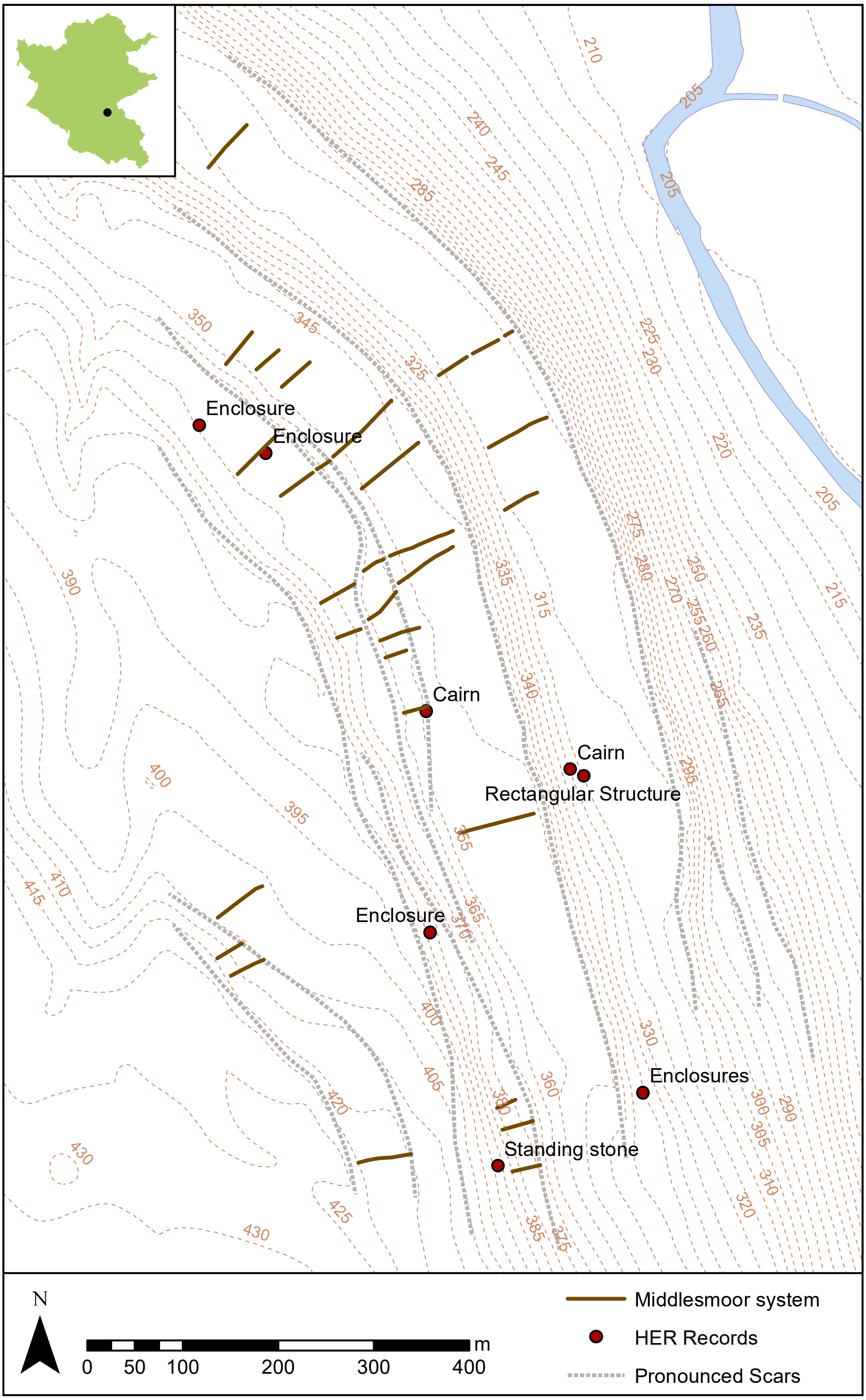


Fig. 4.20 Middlesmoor Pasture coaxial system in relation to features/finds known from the HER.

Fig. 4.21 Coaxial boundary on a natural limestone terrace of the Middlesmoor Pasture coaxial system.

Situated on the Garsdale and Danny Bridge limestones of Upper Wharfedale, this field system is located on the eastern flank of Knipe Hill, a spur separating Wharfedale from Littondale. Facing northeast and overlooking the village of Kettlewell, the hillside rises steeply from the flood plain (*c.*210m aOD) to around 300m aOD, above which it comprises broad terraces separated by four substantial vertical scars and rises to a maximum of *c.*470m aOD. Today the land is used as rough pasture. There is extensive evidence, in the form of shallow shaft mounds, of historic lead mining in the area.

At least 31 boundary fragments are situated on the flat terraces of the hillside, with some terminating at the vertical scar edges and others appearing to continue again above/below the step. The alignment of the boundaries is more radial and less parallel than those of other systems in the dale as the fellside curves around slightly, although it is still noticeable that in the centre of the system, a pair of adjacent boundaries appear to form a funnel shape, running over some of the less steep scars. Several additional enclosures have been identified within the system (see fig. 4.20), though they are currently undated and may represent later pastoral features. Similarly, the cairns may be modern. There is no evidence of artificial transverse boundaries or upper/lower terminals within this system. Standing within the system, the view is a commanding one, both northwest up Wharfedale and across the valley to Grassington-Kettlewell system 1.

4.4.3 Grassington-Kettlewell Group

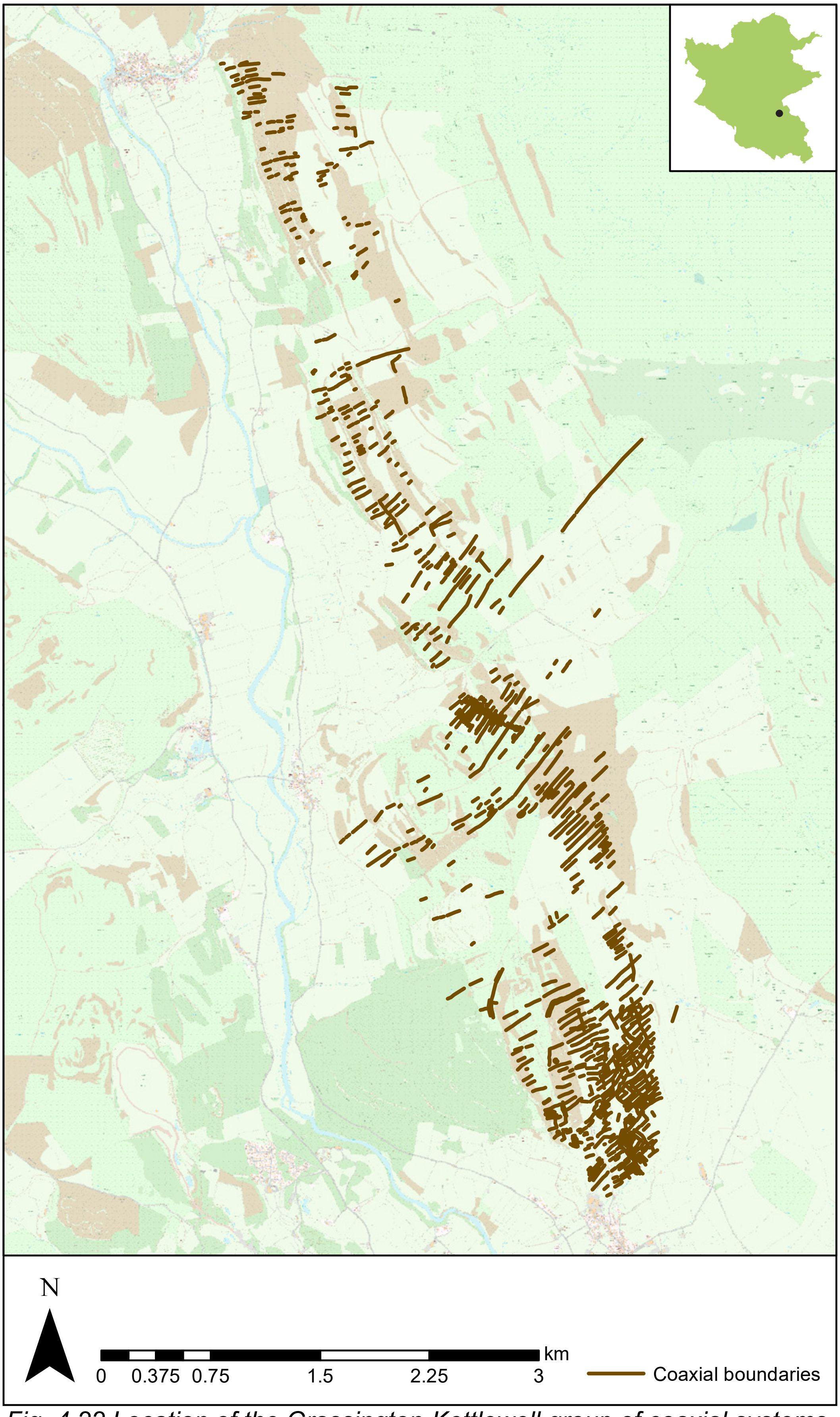


Fig. 4.22 Location of the Grassington-Kettlewell group of coaxial systems.

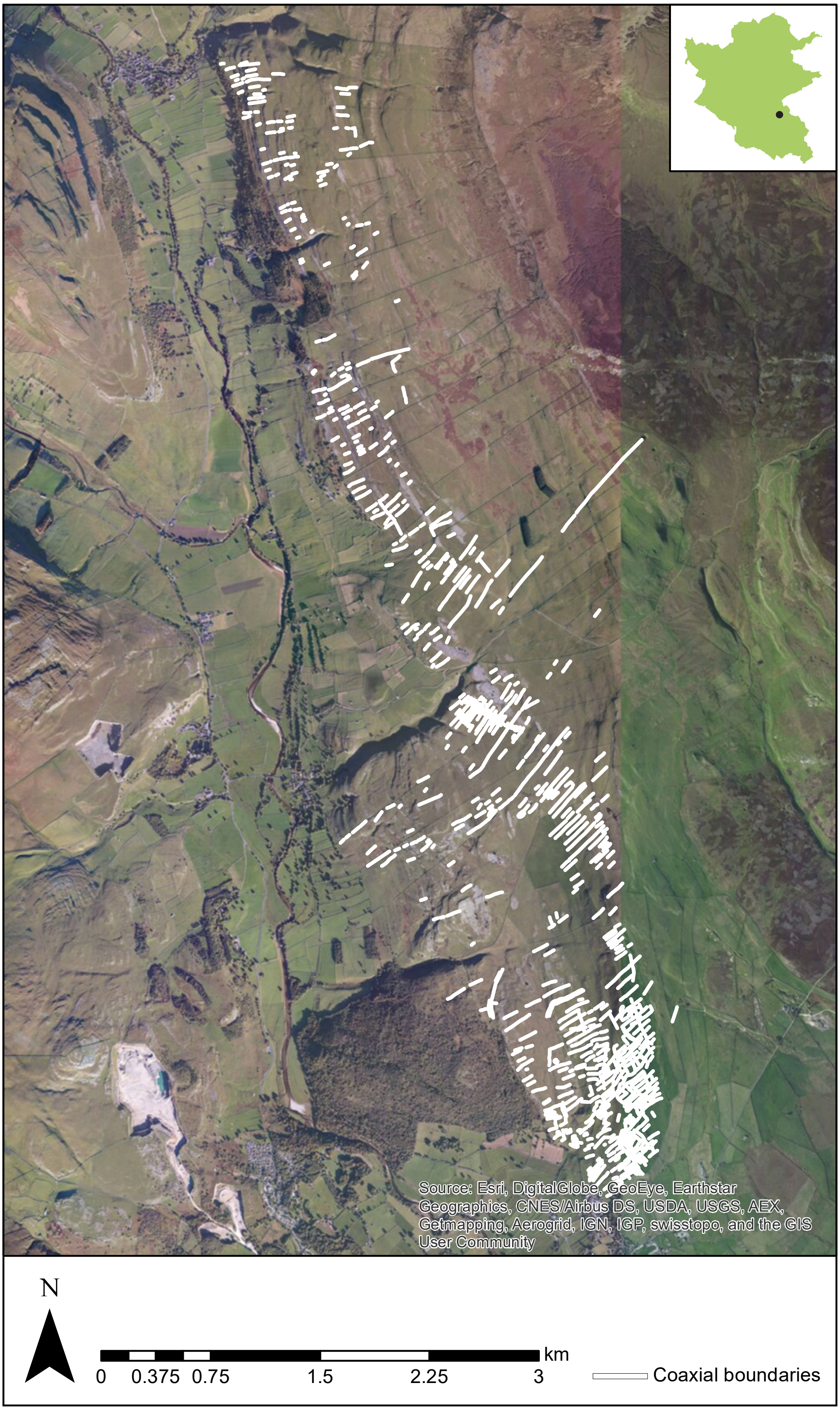


Fig. 4.23 G-K group of coaxial boundaries in geographical context.

Fig. 4.24 Aerial view of Upper Wharfedale and Kettlewell (centre), looking south. Note the flat valley floor, steep sides and stepped upper sides. G-K System 1 is located on the grassland in the top left of the frame; Middlesmoor Pasture System is located on the terraces on the right of the frame. Photo: YDNPA ANY323-22.

Between Grassington and Kettlewell the limestone terraces forming the eastern side of Wharfedale are covered by a network of prehistoric coaxial field systems. These systems are located on the mid-upper valley sides and run from Grassington in the south, at least as far north as Kettlewell, a northerly limit that is marked by the natural topographic boundary of the valley of Dowber Gill Beck. In this area Wharfedale runs approximately north-south, with Littondale branching off to the northwest at the confluence of the Rivers Wharfe and Skirfare. Beyond the classic U-shape of the main valley, the topography is dominated by the almost-horizontal bedding planes of the underlying Great Scar and Alston limestones, which give rise to broad steps in the upper valley sides. Several prominent limestone scars project into the valley here. To the immediate south of Kettlewell, the dale sides run steeply up from the flat flood plain, around 200m aOD, to a line of multiple low scars parallel to the contour that form a 'shoulder' at *c*.300-340m aOD and mark a break of slope between the valley side and the gentler gradient of the enclosed grassland that runs back to the moorland beyond (roughly 2km from the valley side 'shoulder').

Fig. 4.25 View of the eastern side of Wharfedale, showing the scar line above the remains of intensive medieval agriculture. The droveway (marked) separating G-K Systems 2 and 3 is clearly visible running down through the gap in the scar. Photo: YDNPA YDP080-12.

Just to the north of the distinctive knoll of Conistone Pie, a break in the scar line facilitates access between the lower valley and the higher ground across more sympathetic contours. At Conistone, a plateau around 330m at its highest point, delineated by Bull Scar and the glacial meltwater channel of Conistone Dibb, juts out into the main valley, extending south to Grass Wood; to the east of this higher ground, subsidiary ice has formed a sheltered 'bowl' parallel to the main valley, separating pastures such as Capstick Pasture and High Close from the main valley (see fig. 4.27).

Fig. 4.26 View of Conistone Dibb looking west towards Wharfedale. Photo: author.

Fig. 4.27 View of the topography between Conistone Dibb and Grassington, looking south. Grass Wood and the main valley of Wharfedale lie between the two horizons on the right of the frame; the ground drops into a slight 'bowl' before rising up to Grassington Moor off the left of the frame. Photo: author.

Further south still, the hillside has a steep but more uniform gradient, running down to the deserted medieval settlement at Cove Scar and modern Grassington. Soils are typically thin on the limestone, with wetter, peaty deposits on the higher gritstone. The land is currently used predominantly as rough pasture, and as such comprises areas of short cropped grassland, longer grass, bracken and heather; shake holes are abundant.

The six coaxial systems between Kettlewell and Grassington were differentiated as such as part of the Yorkshire Dales Mapping Project (Horne & MacLeod 1995: 36-40), and in the main these divisions have been retained here for clarity (see fig. 4.28), though in some cases it is not clear whether divisions are ‘real’ or merely the product of partial preservation and a modern eye. The original YDMP categorization was not specific beyond placing numerals on a 1:21 000 scale map to accompany the textual description (see Horne & MacLeod 1995: 36-40 and fig. 4.1.1.6b), and while a somewhat less cautious approach to attribution has been applied here *i.e.* the individual boundaries have all been assigned to systems, a zone of uncertainty should still be considered to apply around the circumference of each designated system. Distinctions between the systems are based primarily on differences in alignment between the adjacent systems, but also on differences in character, including the width of the coaxial strips or the frequency of transverse boundaries.

The first system, labelled Grassington-Kettlewell 1 (G-K System 1) here, is located immediately southeast of Kettlewell and runs along Scar Top. To the south of this, G-K System 2 runs back from Swineber Scar. These two systems were originally interpreted as separate from each other on the grounds of an 800m gap between their extents, which contains potentially contemporary settlement remains (Horne & MacLeod 1995: 36), however this inevitably raises the issue of the degree of satisfaction provided by negative evidence, particularly as both systems are very similar in character and neither has evidence for a definitive extremity. The southern end of G-K System 2 lies on a slightly different alignment to G-K System 3, situated on New Close Allotments, and although they appear to overlap, the projected points in question are located on areas of limestone pavement and are therefore difficult to disentangle (Horne & MacLeod 2001: 73).

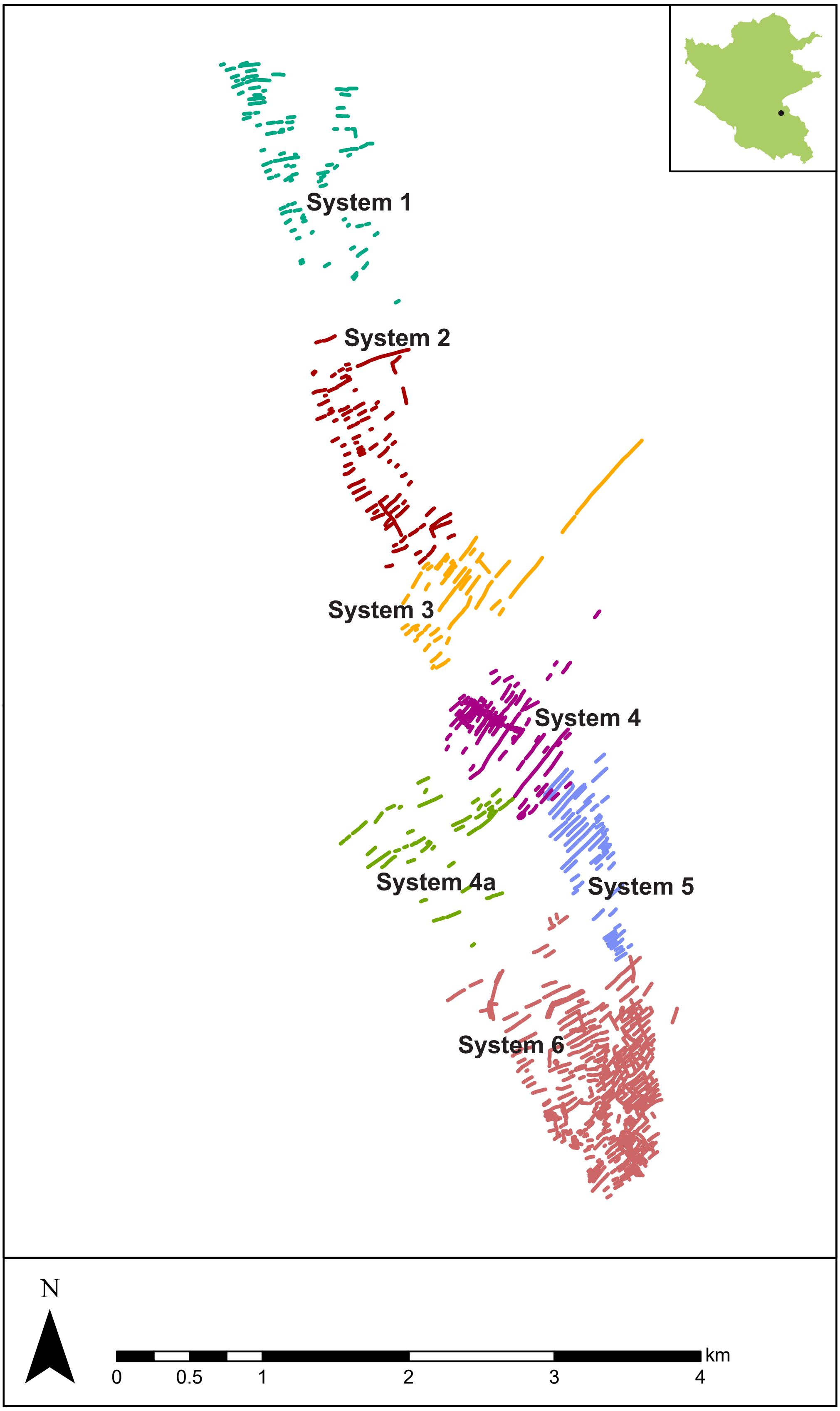


Fig. 4.28 Relative positions of field systems G-K 1-6.

G-K System 4 lies on a very similar alignment to G-K System 3, yet their separation is marked by the topographical interruption of Coniston Dib (see fig. 4.26), as well as an unusually long coaxial boundary marking what appears to be the southern extent of G-K System 3. The central focus of G-K System 4 appears to be around the scar line leading south from the head of Conistone Dib, however the YDMP report also incorporated into this system a number of boundary fragments that are located to the west of the densest concentration of boundaries, on the plateau of Old Pasture above the village of Conistone; although the majority of the fragments (largely aligned parallel) are aligned at an angle to the more structured area of boundaries upslope, this interpretation as part of the same system was made on the grounds that the most complete boundary curves part way along, coming into closer line with the fragments on Old Pasture (Horne & MacLeod 1995: 38). Such a deviation in direction seems unusual, and these lower boundaries are referred to here as G-K System 4a. Systems 4 and 4a are very difficult to distinguish from G-K System 5, which lies to the south, and indeed the systems, which run on a very similar alignment, appear to overlap. Likewise, G-K System 5 seems to overlap with G-K System 6, located immediately to the south on Lea Green and Sweetside, although the most southerly system is differentiated by its very different morphology. To the south of G-K System 6, the later development of Grassington (and its predecessor, assumed to be the abandoned Cove settlement) prevent the identification of further archaeological remains, while visibility is limited to the east by historic lead mining landscapes.

4.4.4 Grassington-Kettlewell System 1

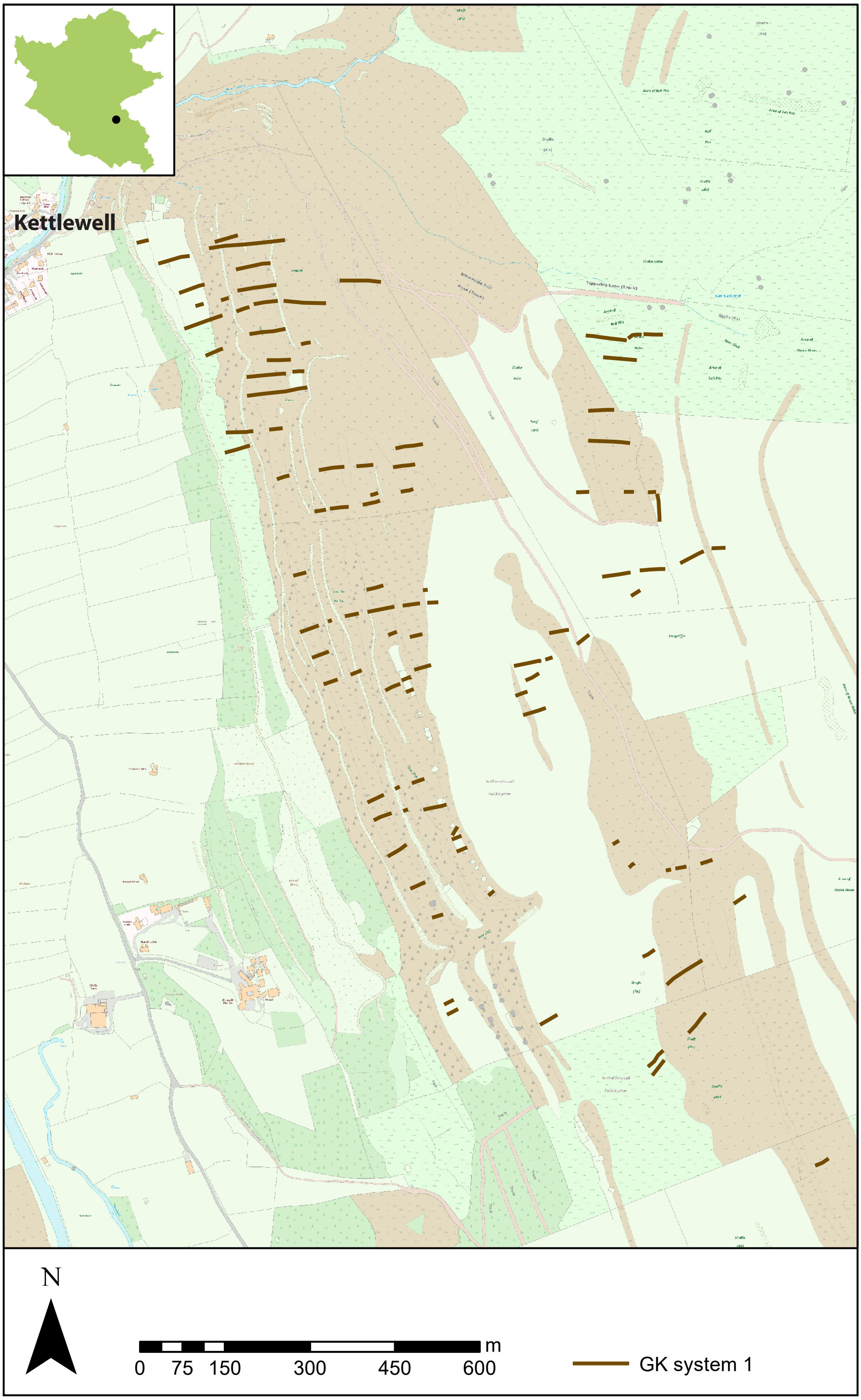


Fig. 4.29 Location of Grassington-Kettlewell 1 coaxial system.

Fig. 4.30 G-K 1 coaxial boundaries in geographical context.

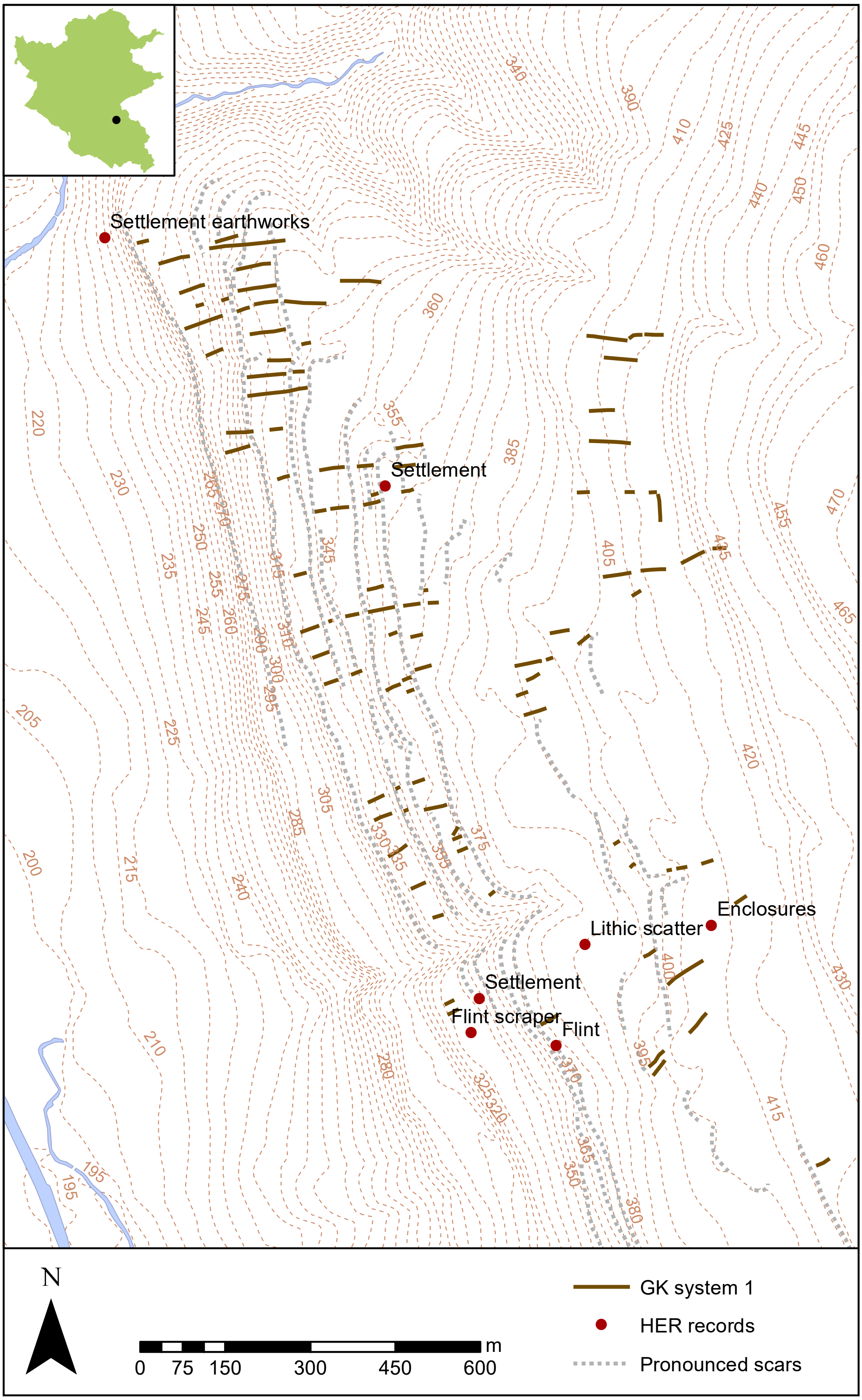


Fig. 4.31 Grassington-Kettlewell 1 coaxial system in relation to features/finds known from the HER.

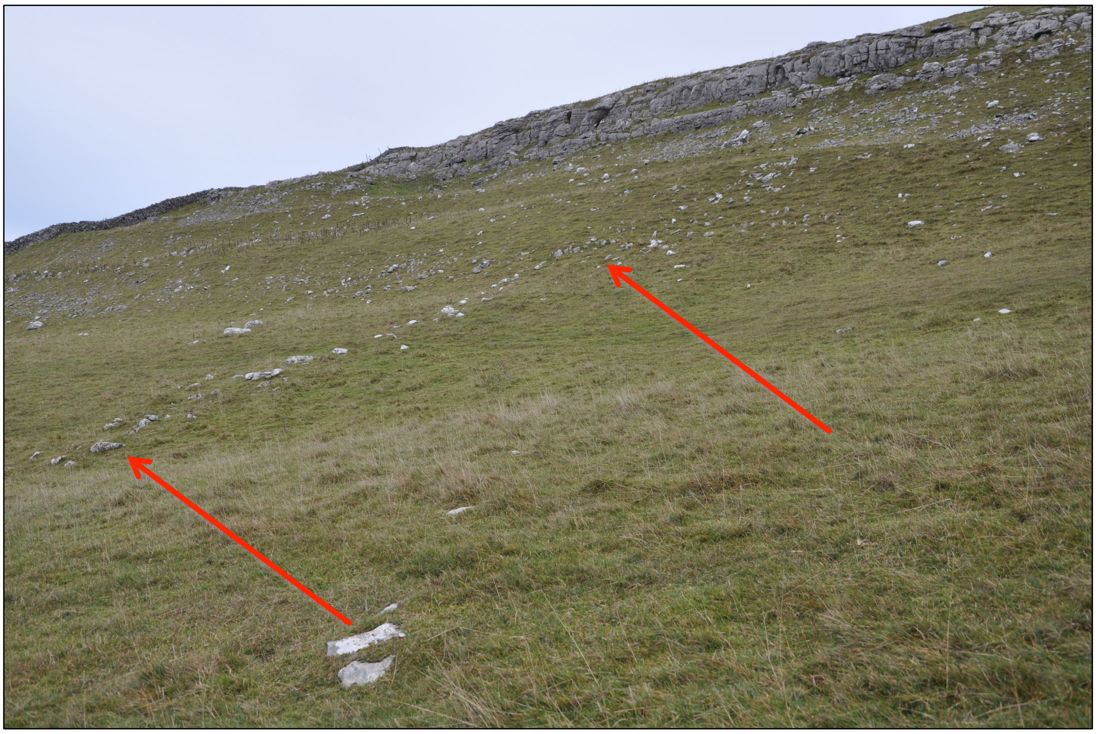


Fig. 4.32 An axial boundary running downhill from the scar line in the southern part of G-K System 1. This is the most downslope (and also the steepest) part of the System. Photo: author.

Situated among the horizontal limestone scars that characterize the upper valley side to the south of the village of Kettlewell, the most northerly of these systems, G-K System 1, covers an area of approximately 102ha, although its southern extent is not clearly defined. One of the larger Wharfedale systems, G-K System 1 spreads roughly 2km along the valley side and 850m back from it (*i.e*. from a minimum elevation of 285m to a maximum of 440m). Horne & MacLeod described the system as having a "fragmentary appearance" due to the frequency with which the limestone scars cut across the coaxial boundaries, running perpendicular to them; it may not be coincidental that there is no indication of artificial transverse boundaries in this area, given the prevalence of natural substitutes (Horne & MacLeod 1995: 36). It is possible that the detached group of boundaries higher up the hillside represent a separate field system(s), however, working on the assumption that they are a continuation of those lower down gives a total measureable meterage of boundaries in the system of just over 3700m.

Numerous small enclosures are present within the field system, particularly in the south of the area and below scar lines, taking the form of well-defined rubble and earthwork building remains such as are common in this part of Wharfedale. Many have been attributed a late prehistoric date through comparison with known Iron Age/Romano-British structures, though most are of a generic form that would not be out of place in later millennia and none have been verified by excavation.

4.4.5 Grassington-Kettlewell System 2

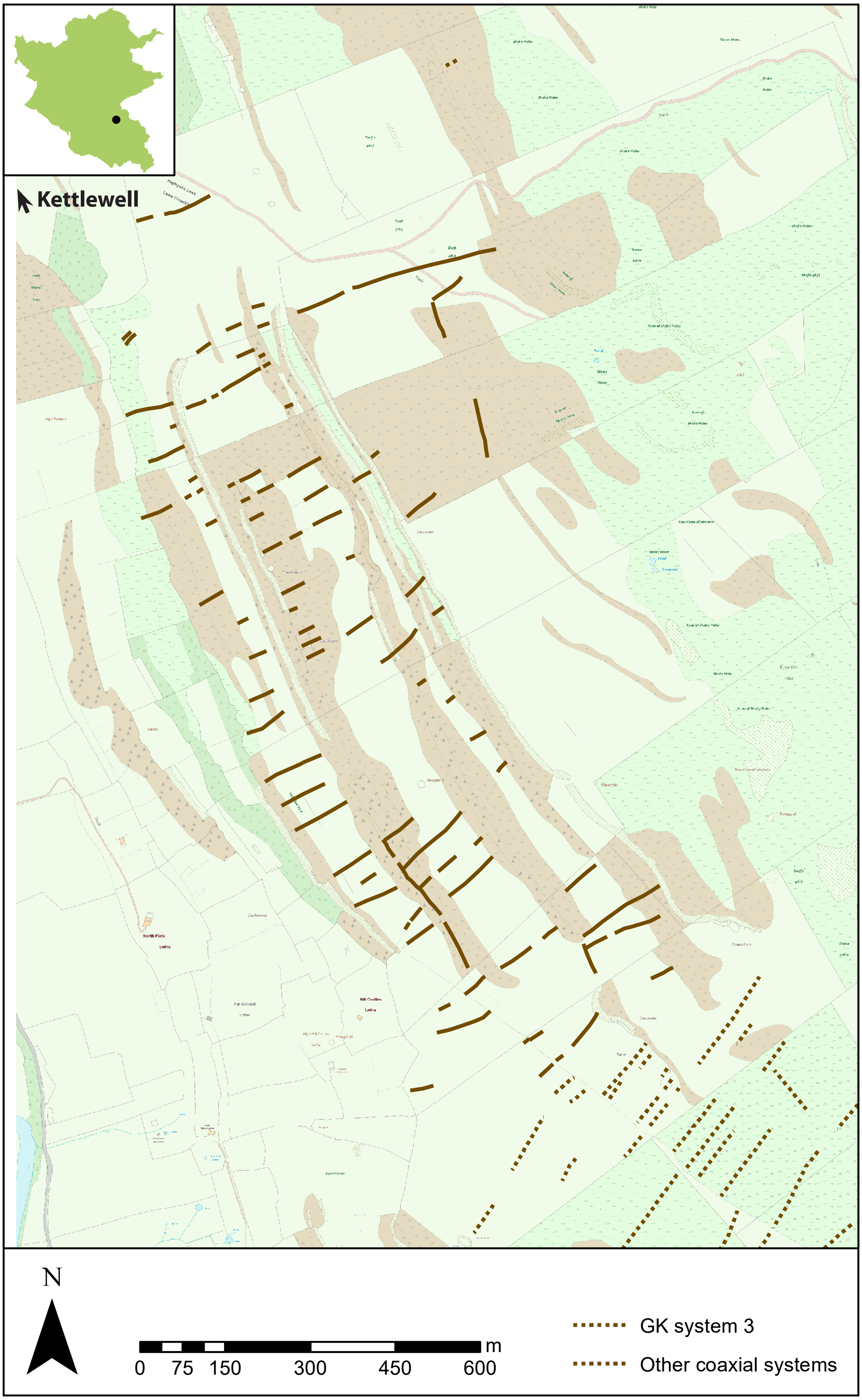


Fig. 4.33 Location of Grassington-Kettlewell 2 coaxial system.

Fig. 4.34 G-K 2 coaxial boundaries in geographical context.

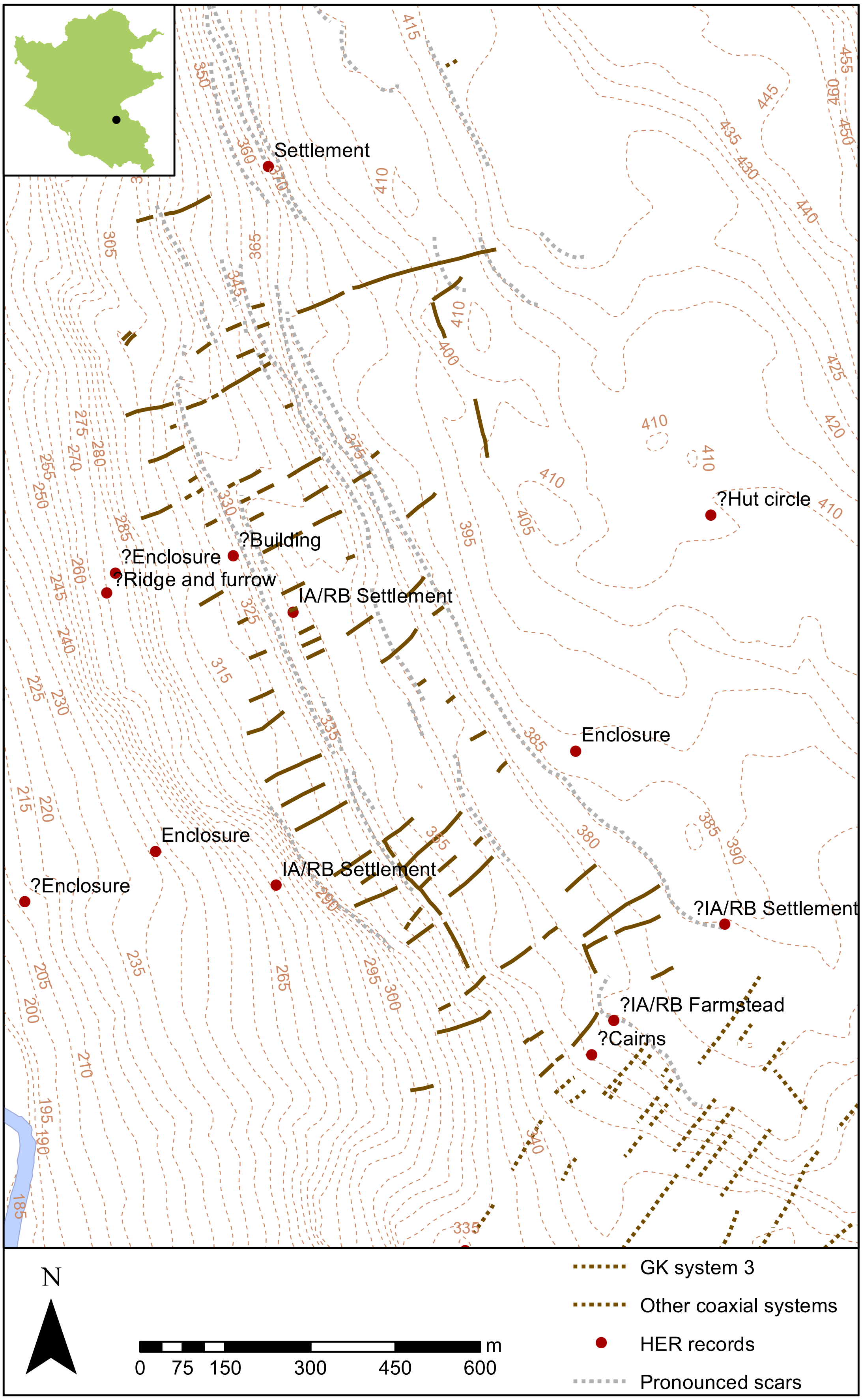


Fig. 4.35 Grassington-Kettlewell 2 coaxial system in relation to features/finds known from the HER.

G-K System 2 is similar in character to its northern neighbour, in that it comprises a number of boundaries running back from the shoulder of the valley side, intersecting the frequent longitudinal scars at right angles. Covering an area of roughly 98ha, with maximum dimensions of *c*.1.8km along the valley side and *c*.820m running back across the contour, almost 5900m of boundaries have been identified. These cover land between a minimum of 305m aOD and a maximum of 415m aOD. Towards the northern extent, a possible section of terminal boundary is visible. Towards the southern part of this system, a possible lower transverse boundary exists, abutted by several axial boundaries and running along the top edge of a low scar; the role of this boundary as a terminal for at least part of the life of the system is supported by its relationship to axials on the terrace below it, which are laterally offset, despite the gradual slope of the scar and possibility for building over it (Horne & MacLeod 1995: 37). The southern extent of this system coincides with a later droveway (see below). As visible in fig. 4.35, several areas of settlement have been identified that are recorded in the HER as being of Iron Age or Romano-British date; as is the case in G-K 1, they have not been definitively dated.

4.4.6 Grassington-Kettlewell System 3

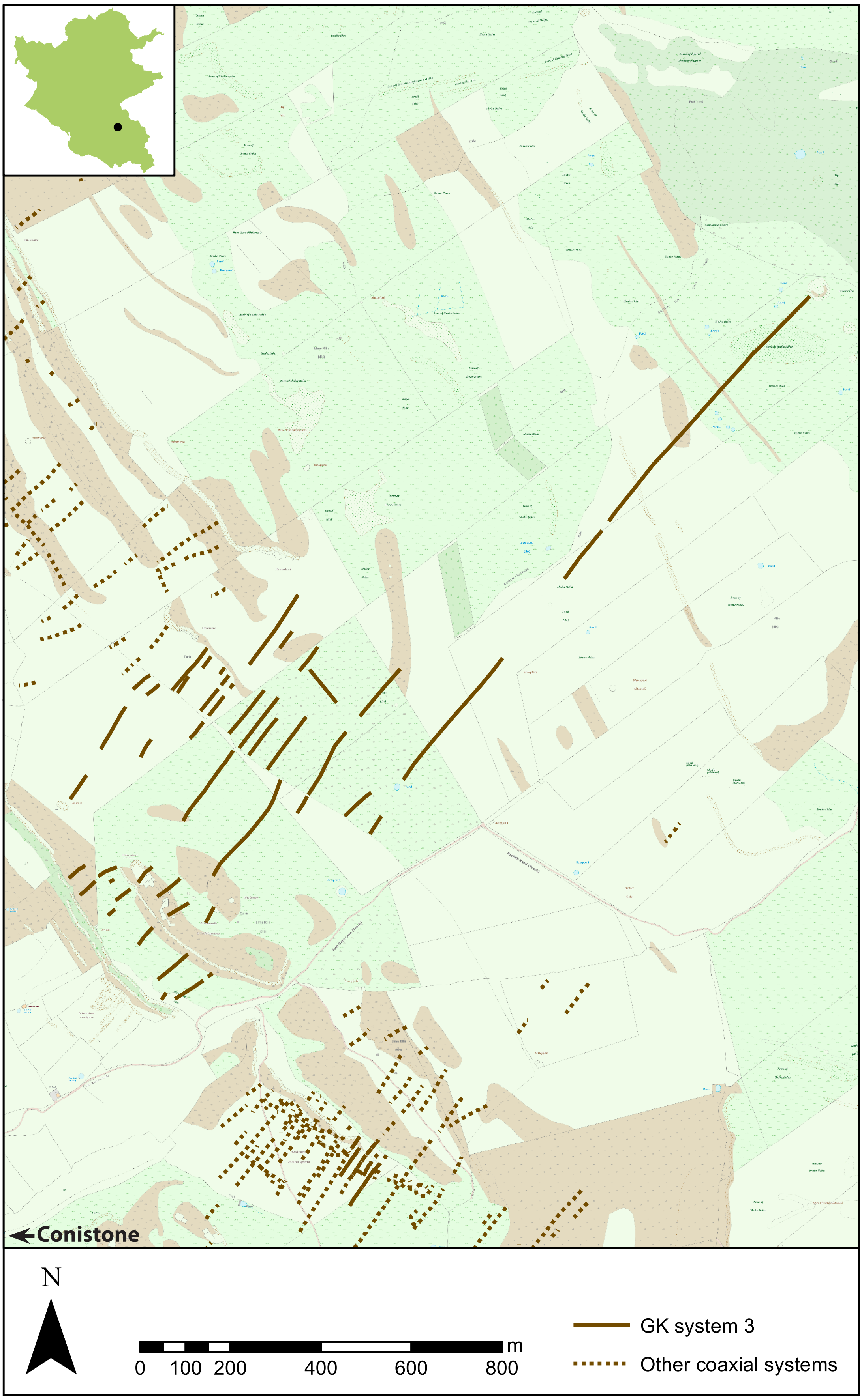


Fig. 4.36 Location of Grassington-Kettlewell 3 coaxial system.

Fig. 4.37 G-K 3 coaxial boundaries in geographical context.

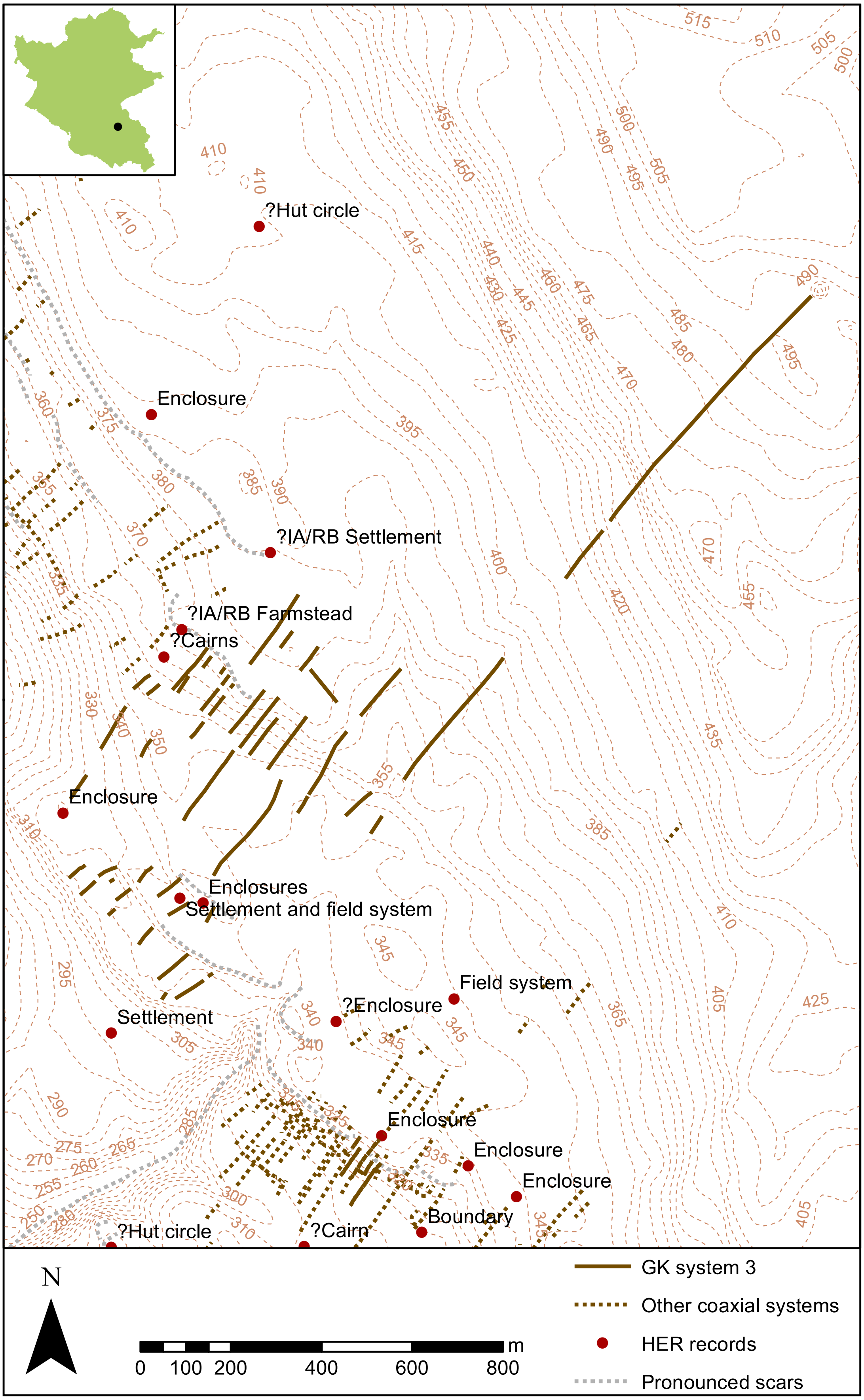


Fig. 4.38 Grassington-Kettlewell 3 coaxial system in relation to features/finds known from the HER.

Fig. 4.39 View looking east from the line of Hill Castles Scar, which marks the 'shoulder' of the valley sides, across the hillside on which G-K System 3 is located. The incremental terraces are visible.

The remains of G-K System 3 are somewhat more regularly spaced than the more northerly systems, as well as being more narrowly spaced. The visible remains of the system extend across 64ha, with maximum dimensions of approximately 660m along the contour and typically *c.*800m to the northeast *i.e*. back from the valley, although the southern-most boundary extends beyond this. A break in the scar line, and a gentler gradient, in the northern part of this area corresponds with a spread of medieval cultivation remains higher up the valley side; consequently the southwesterly (downslope) edge of the coaxial system is difficult to locate and potentially truncated. The visible remains range from 320m aOD to 385m aOD, with one boundary running as far as the 490m contour.

A droveway, which crosses the most northerly two coaxial strips of the system, runs down to, and fades out among, the lynchets of the lower valley side. Its upper end forms a funnel shape, located as though to allow access to the highest grazing. While its relationship with the coaxial fields and lower lynchets indicates a later date than G-K System 3, its reuse of an axial boundary as its southern side for approximately 150m below its highest point suggests the coaxial system was still extant at this time; at its highest point, this southern side turns sharply south, and it has been traced on aerial photographs running southeast to meet the southern-most axial boundary of the system (Horne & MacLeod 2001: 75-76).

The southern most axial boundary runs beyond the elevation of the droveway, approximately 1500m up the hillside onto New Close Allotments until it reaches a particularly large sink hole of around 40m diameter; depending on the age of the sink hole in question, it is reasonable to assume that this is a deliberate alignment. During the course of its journey towards the valley, this boundary is also aligned on a modern pond, which is located a short distance (several metres) away from a spring that may have been significant in the original layout (Dave MacLeod, pers. comm.).

4.4.7 Grassington-Kettlewell System 4

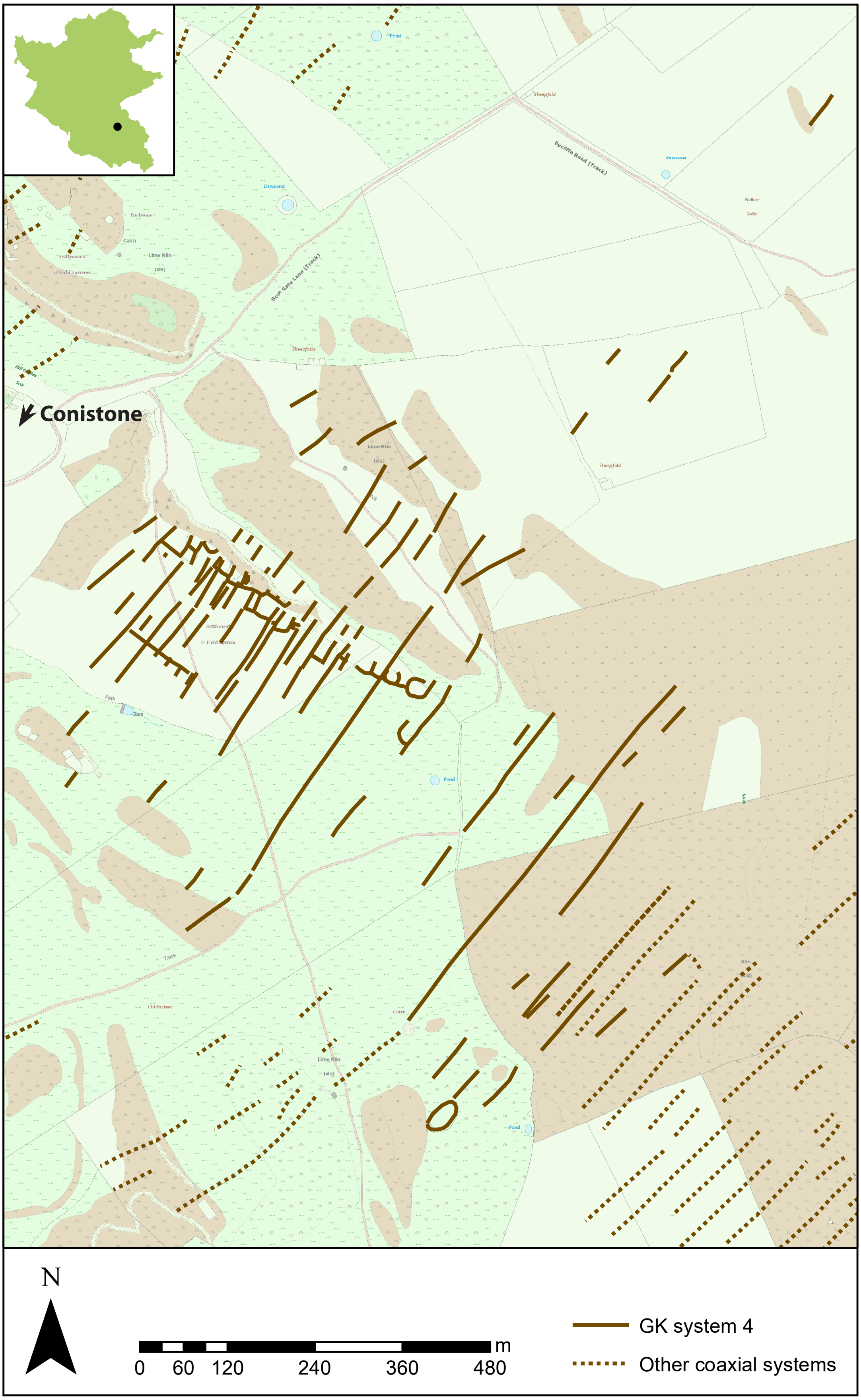


Fig. 4.40 Location of Grassington-Kettlewell 4 coaxial system.

Fig. 4.41 Grassington-Kettlewell 4 coaxial boundaries in geographical context.

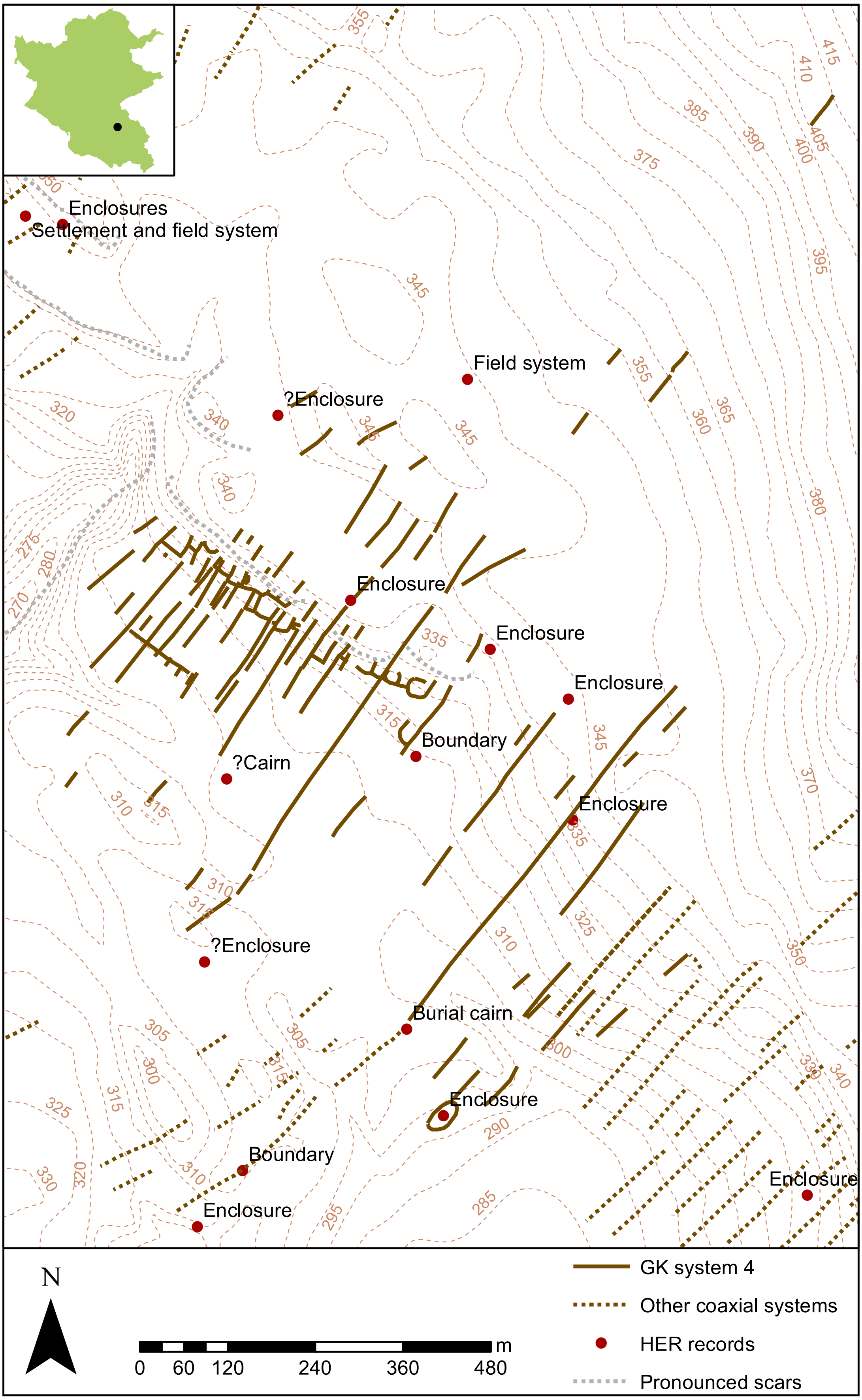


Fig. 4.42 Grassington-Kettlewell 4 coaxial system in relation to features/finds known from the HER.

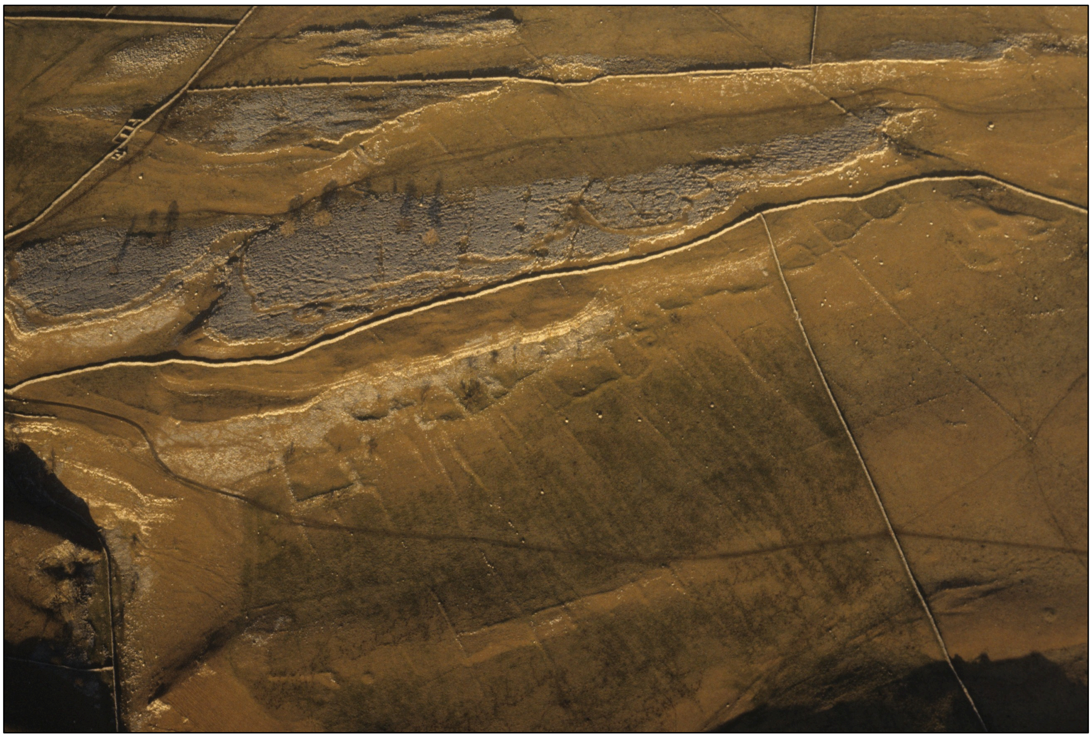


Fig. 4.43 Aerial view looking east of G-K System 4, located immediately south of Conistone Dibb (just visible on the left of the frame). The scar line bisects the frame with coaxial boundaries visible below and above it, and settlement remains immediately below it. Photo: YDNPA ANY336-8.

Fig. 4.44 View of coaxial boundaries of G-K System 4, looking southeast from below the scar line. The end of the scar is just visible on the left of the frame and axial boundaries are indicated. Photo: author.


Fig. 4.45 A building platform below the scar in G-K System 4. Photo: author.

G-K System 4 is bisected by the scar line running southeast from Conistone Dib. Along the foot of this scar are the remains of linear settlement (MYD4022) - small buildings and plots - which have been assigned an unsubstantiated Iron Age date by the YDMP (Horne & MacLeod 1995: 38). While some coaxial boundaries terminate at the settlement, others continue above the scar and run northeast across an area that is now limestone pavement before fading out. It appears from their close positioning and varying alignment that not all the axial boundaries are contemporary or necessarily contemporary with the settlement.

This part of the system (that is, System 4, as distinct from 4a) covers around 66ha, with maximum dimensions of around 1000m along the valley side and 1120m running up hill. The system appears around 305m aOD, and rises to around 370m aOD with an outlying fragment reaching beyond this. Horne and MacLeod recognised frequent transverse walling (1995: 38), however this is less visible on the available aerial imagery. The visible evidence suggests this is a more compact system than those to the north, with a narrower, and perhaps more regular, average distance between axial boundaries.

4.4.7 Grassington-Kettlewell System 4a

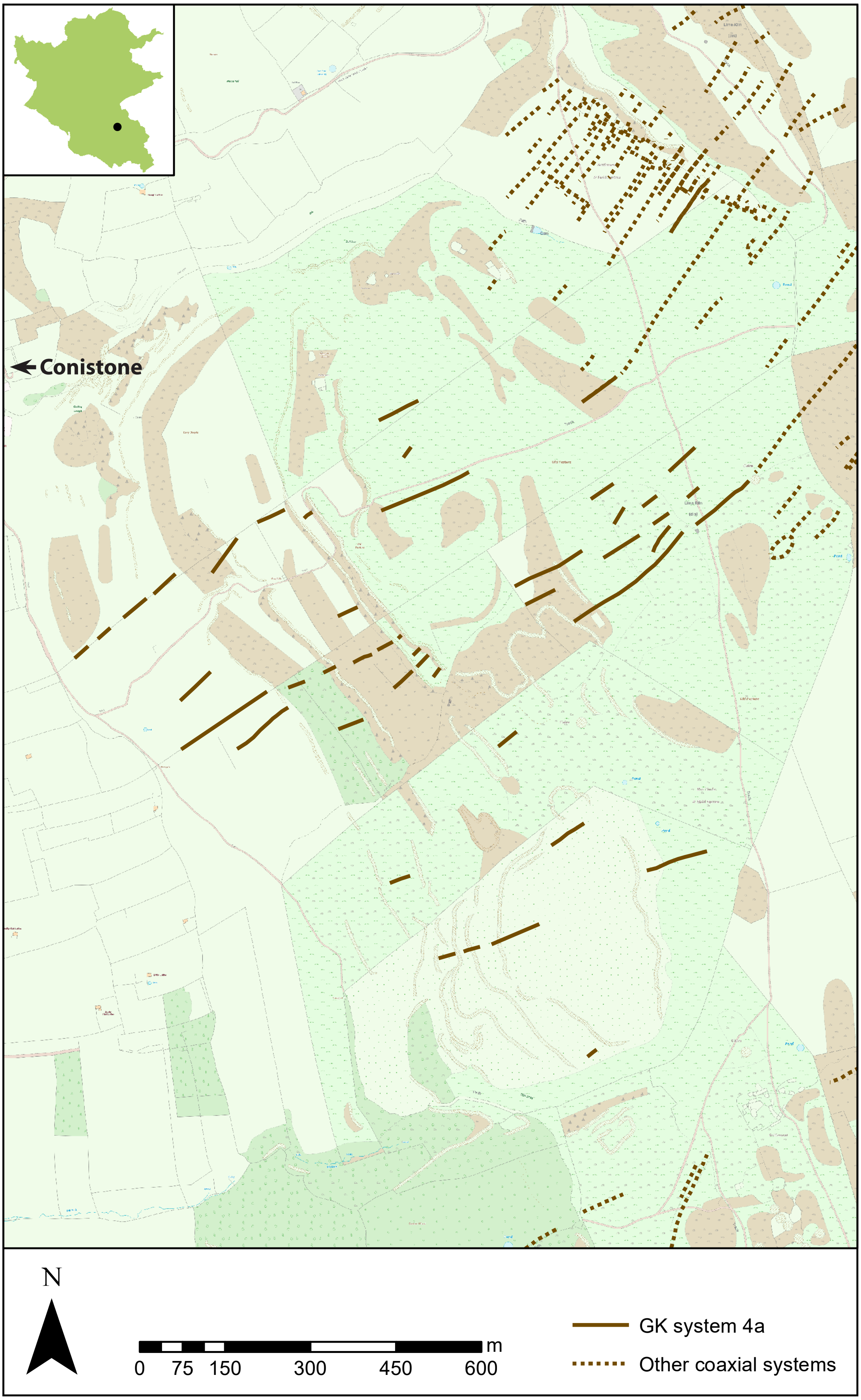


Fig. 4.46 Location of Grassington-Kettlewell 4a coaxial system.

Fig. 4.47 Grassington-Kettlewell 4a coaxial boundaries in geographical context.

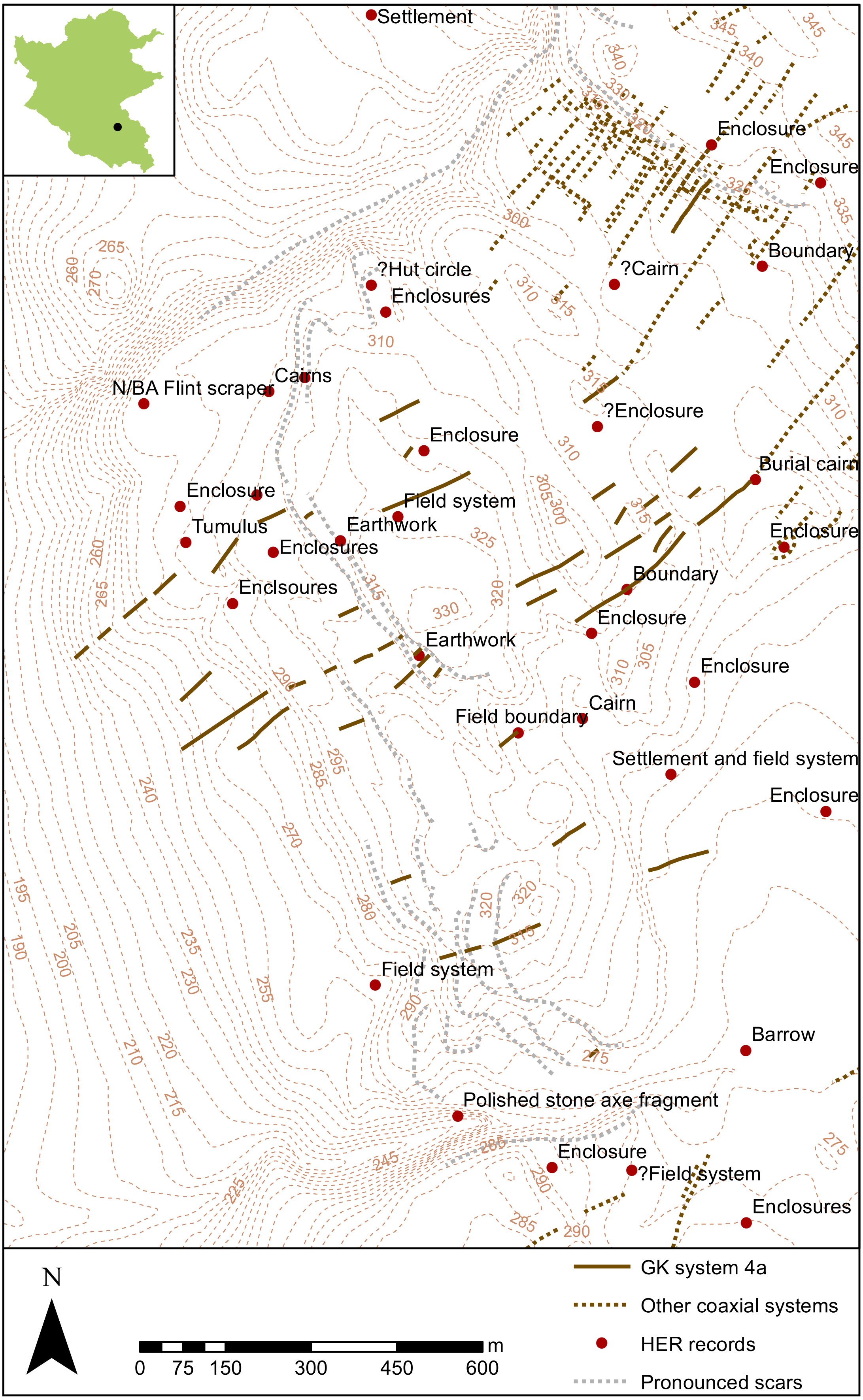


Fig. 4.48 Grassington-Kettlewell 4a coaxial system in relation to features/finds known from the HER.

Fig. 4.49 Overview of G-K System 4a, looking southwest across the plateau south of Conistone Dib (the Dib bisects the frame, immediately behind the stone wall). The scar/settlement of G-K System 4 is just out of shot to the left. Photo: author.

To the southwest of System 4, the evidence for G-K System 4a covers around 92ha of the plateau bordered to the north by Conistone Dib, running approximately 1180m northwest-southeast and approximately 1020m northeast towards the settlement of System 4. Aligned at several degrees to G-K System 4, System 4a is much more fragmented. Horne & MacLeod have identified the alignment of the latter as potentially similar to that of a single, relatively complete boundary that runs down the hillside from System 4, diverging from its alignment to follow that of System 4a (Horne & MacLeod 1995: 38).

As noted above, the possibility of the alignment of boundaries in G-K System 4 on a barrow was raised by Horne & MacLeod (1995: 39). The barrow (MYD 4025), the subject of antiquarian excavation that concluded it to be of early Bronze Age construction with Iron Age reuse, is positioned just below a slight crest running approximately east-west on the plateau between Systems 4 and 5. An axial boundary of System 4 runs directly towards the barrow, possibly continuing at a slight angle (in line with the fragments of System 4a), although another, single bank that is not obviously associated with either field system is also aligned on the barrow.

Fig. 4.50 View looking east along a G-K System boundary, which appears to be aligned on a Bronze Age barrow (indicated); a second, apparently unrelated, boundary runs downhill towards the barrow from the opposite direction (also indicated). Photo: author.

4.4.8 Grassington-Kettlewell System 5

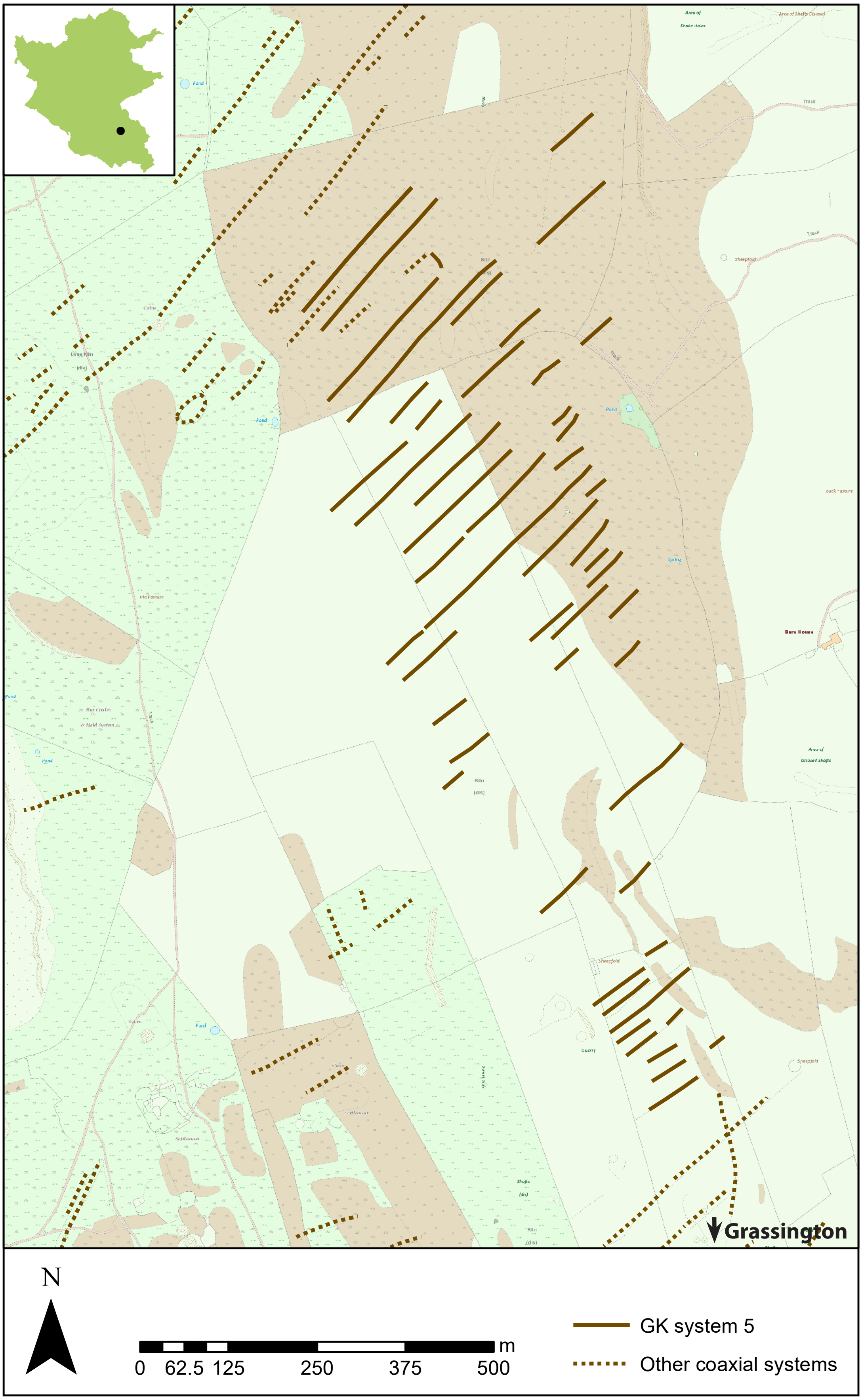


Fig. 4.51 Location of Grassington-Kettlewell 5 coaxial system.

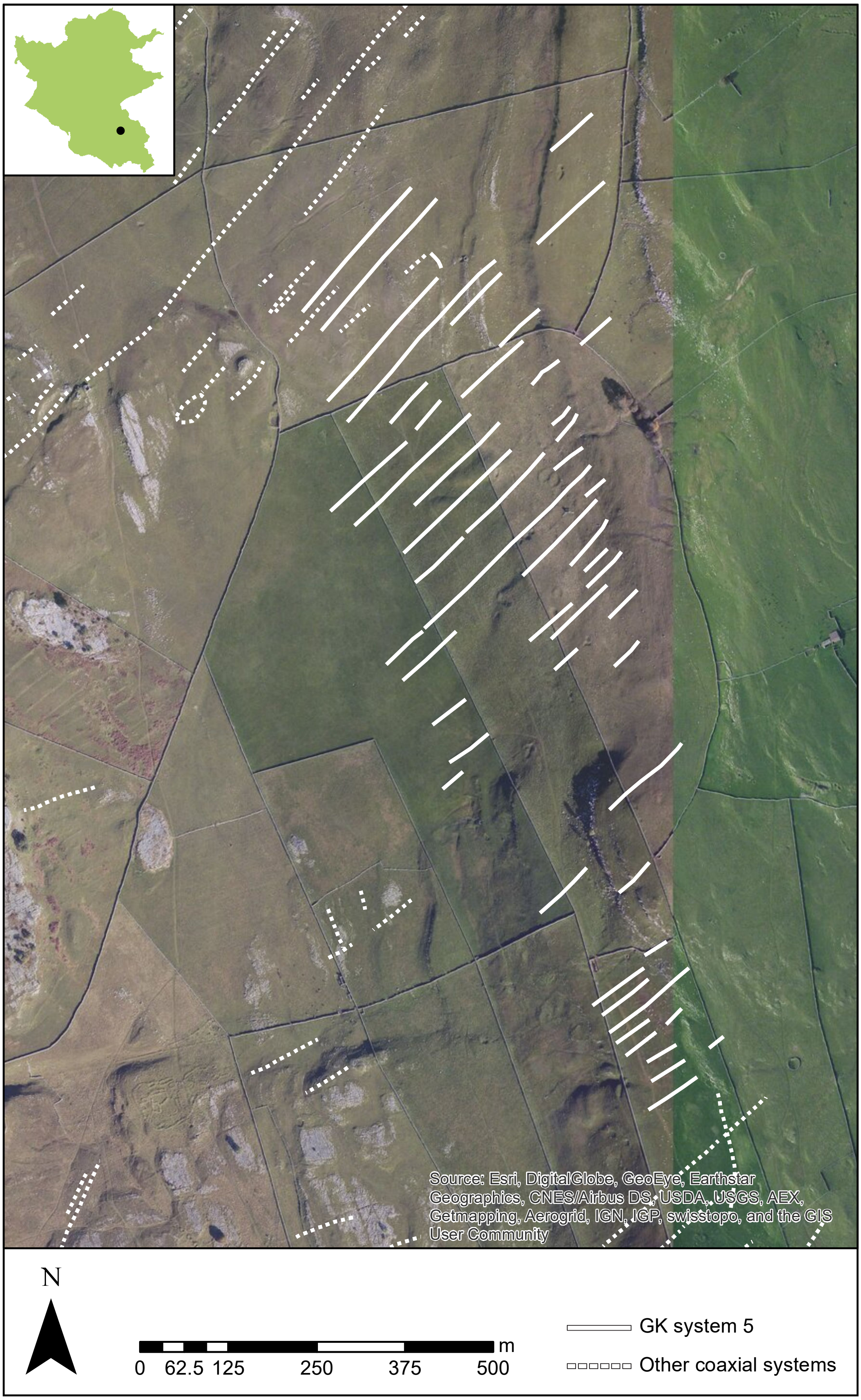


Fig. 4.52 G-K 5 coaxial boundaries in geographical context.

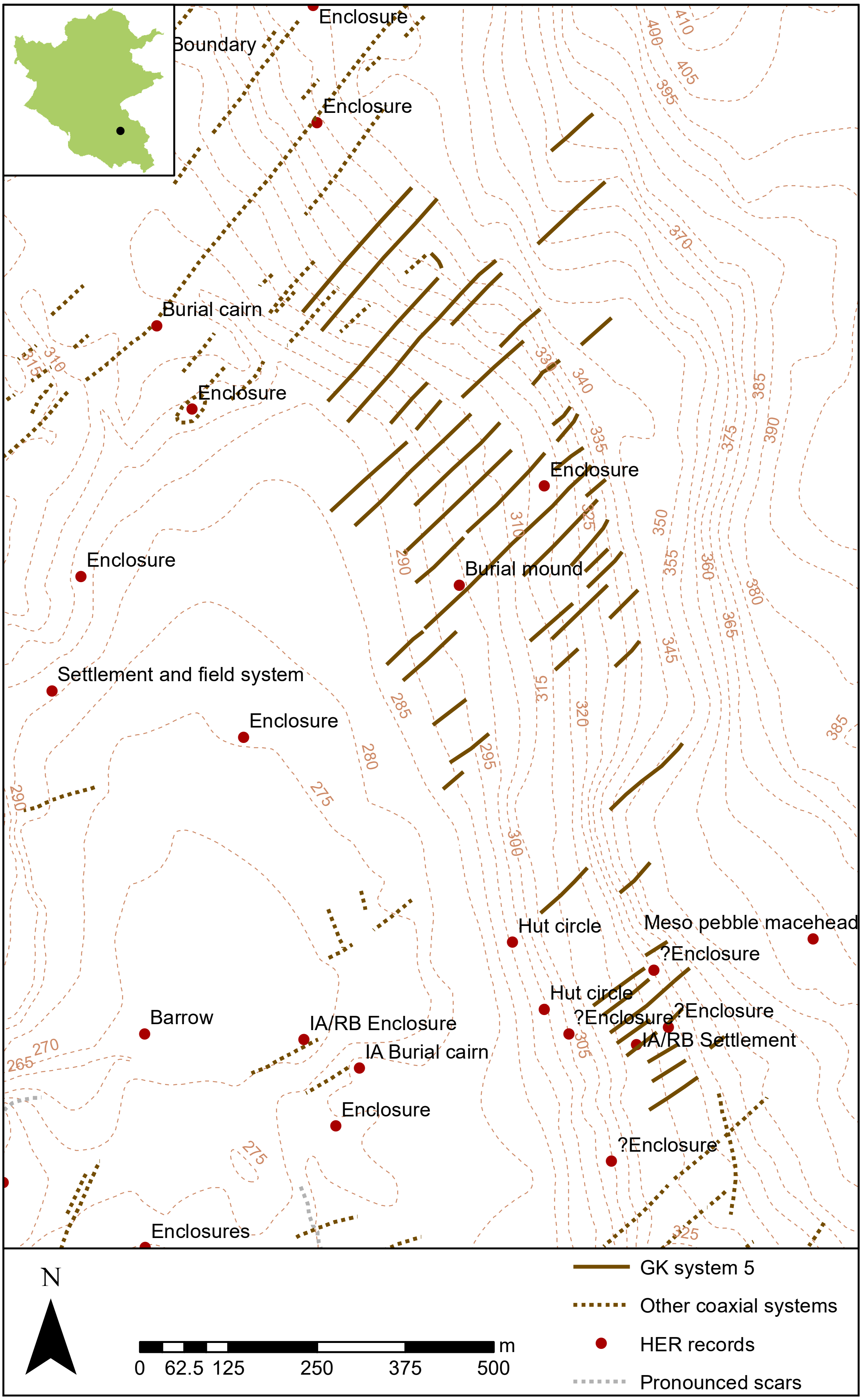


Fig. 4.53 Grassington-Kettlewell 5 coaxial system in relation to features/finds known from the HER.

Fig. 4.54 View across the lynchet-ized (probably reused) southern portion of G-K System 5 looking east. Photo: author.

G-K System 5 covers an area of around 53ha. Situated on the eastern side of the topographic 'bowl' described above, it ranges in elevation from 240m aOD to 365m aOD. A total of around 7000m of boundaries have been identified in an area stretching *c*.1560m along the valley and *c*.740m upslope, although its northern and southern extents are difficult to identify. Within its northern extent, a boundary, composed of large boulders, runs down the hill, seemingly aligned on the barrow noted above (MYD4025). On the grounds of alignment, and, perhaps, composition, this conspicuous boundary does not seem to 'belong' to either G-K System 4 or 5. Horne and MacLeod have likened it to the long, southern-most boundary of G-K System 3, and suggested that it may have been involved in early laying out of the systems.

An obvious dearth of boundaries is visible in the central portion of the plan (fig. 4.51-4.53); this coincides with an area of improved pasture (the difference in colours of the grass in fig. 4.52 gives an indication of the extent of this) and it is likely that axial boundaries of this system originally spread further down towards the main valley. The boundaries of this system are noticeably straight, well preserved and even, and the suspicion is that they have been reused at a later date. Particularly towards the southern extent of the system, a number of very straight, lynchetted boundaries run down the hillside, differing in character from the more northerly boundaries and suggesting later reuse of or encroachment onto part of this system. Several other chains of lynchets, of unknown date, are visible in this vicinity, albeit on significantly different alignments to the coaxial system.

4.4.9 Grassington-Kettlewell System 6

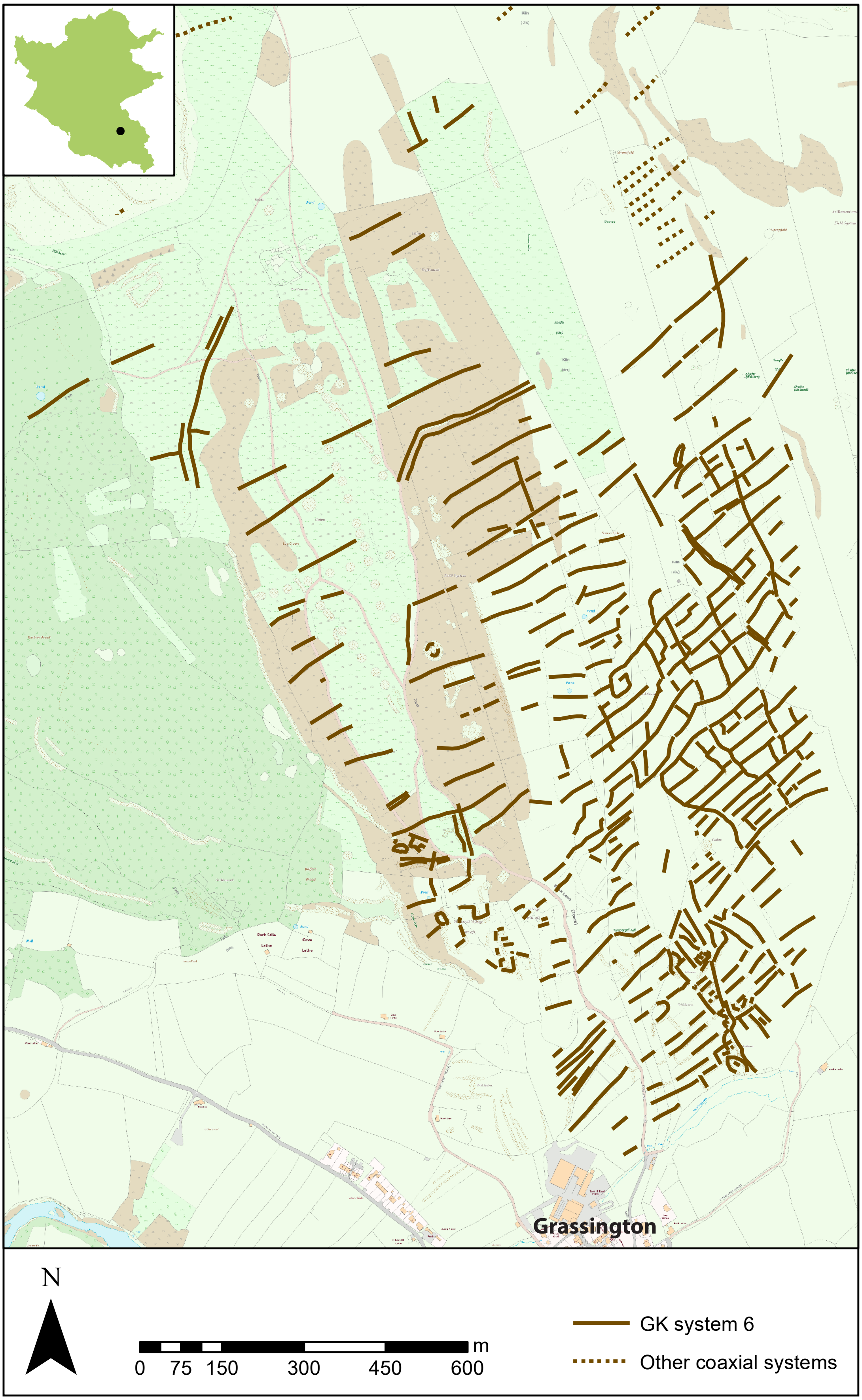


Fig. 4.55 Location of Grassington-Kettlewell 6 coaxial system.

Fig. 4.56 G-K 6 coaxial boundaries in geographical context.

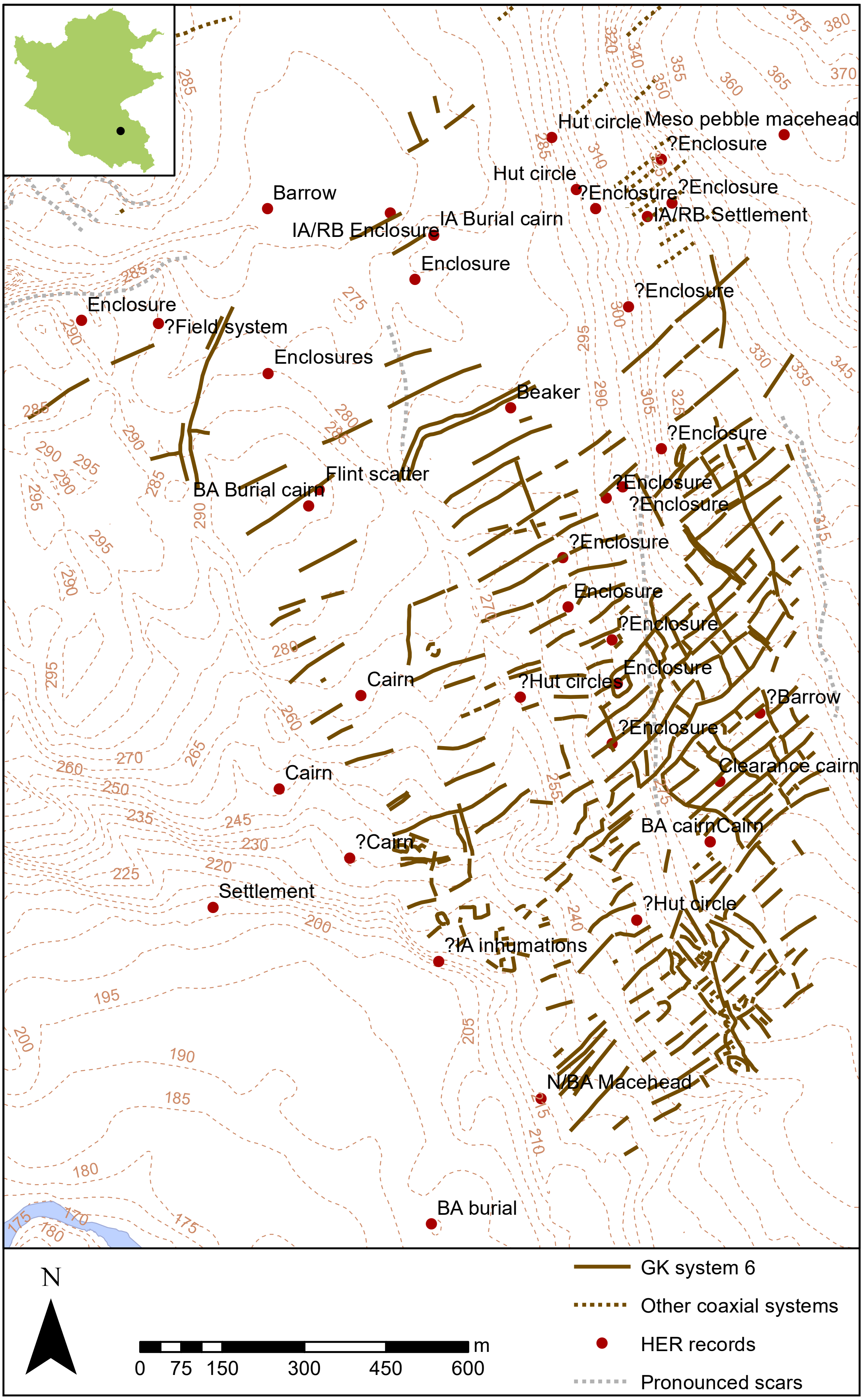


Fig. 4.57 Grassington-Kettlewell 6 coaxial system in relation to features/finds known from the HER.

Fig. 4.58 Aerial view of G-K System 6, looking south towards the edge of Grassington. Note the frequent transverse boundaries and irregular enclosures indicating likely reuse. The remains of the medieval precursor of Grassington lie towards the top right of the frame. Photo: YDNPA ANY336-11.

Fig. 4.59 Looking east across small square fields above Grassington, towards the main valley of Wharfedale. Photo: author.

From its distinct morphology (figs. 4.55-4.57), the evidence for Grassington-Kettlewell System 6 has been interpreted as representing the Romano-British, and probable Medieval, reuse of the original coaxial boundaries that are visible around the edges of the system (Horne & MacLeod 1995: 39-40). Later activity in this area may have been linked to that centred on the deserted 'medieval' settlement of the Cove. Although the northern extent is difficult to pinpoint, the system covers around 156ha, measuring around 1900m northwest-southeast and running approximately 1500m upslope from 220m aOD to 345m aOD, and as such is one of the largest systems in the Dales. The density of the axial boundaries and frequency of small transverse enclosure divisions results in the identification of around 23 805m of boundaries. Prominent features include three probable droveways, possible individual farmsteads and curvilinear enclosures. As a result of the intensity of such reuse, the field system can be described as 'coaxial only by default', although remains likely to represent the original coaxial system are visible upslope from the lower terminal boundary (that is, the lower scar line) (Horne & MacLeod 1995: 40). This area was a focus for antiquarian activity (see Section 2.2), not least because of the relative prevalence of prehistoric burial cairns, each located in prominent locations within the local landscape (e.g. with good lines of sight).

4.4.10 Kilnsey Systems 1 and 2

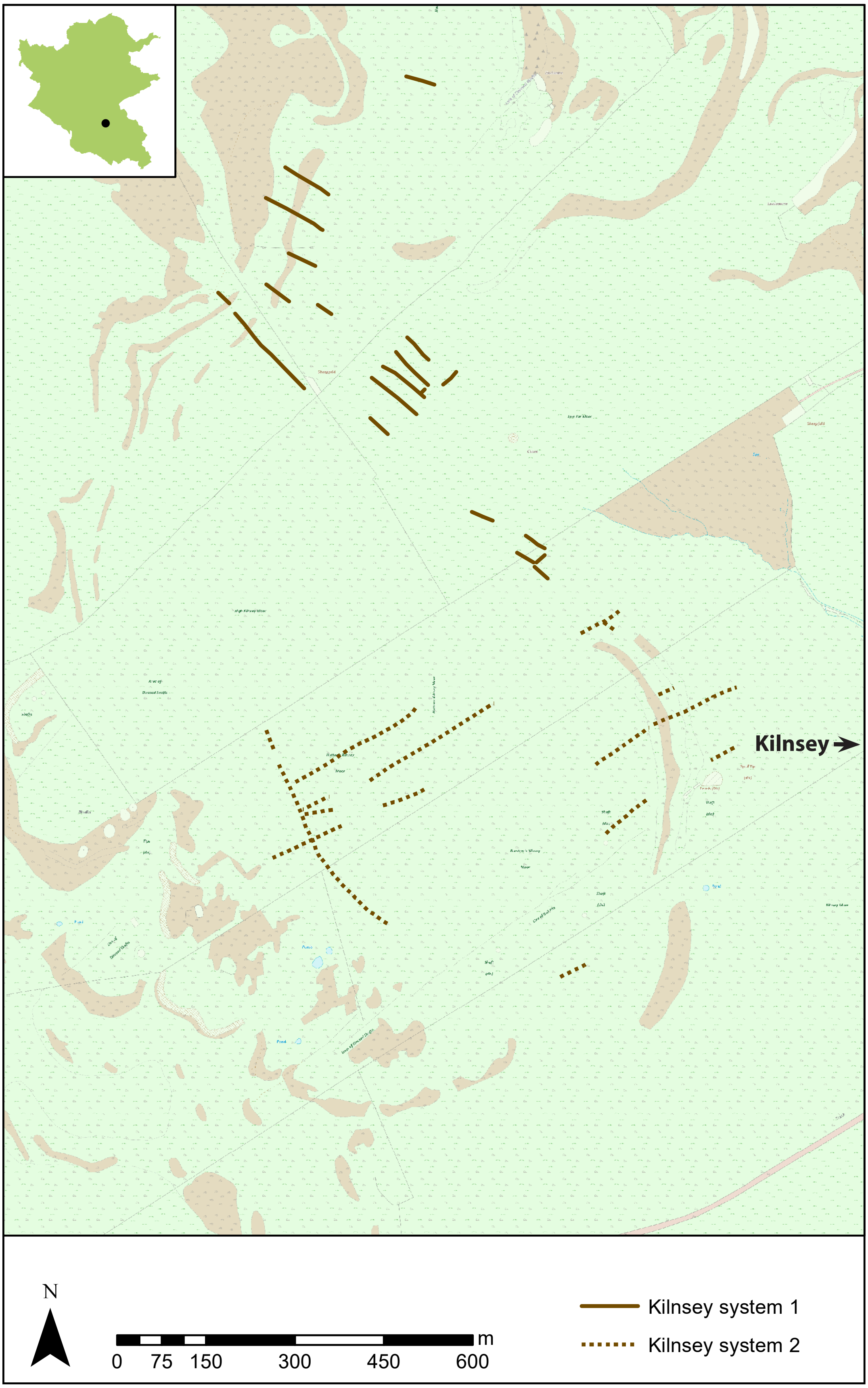


Fig. 4.60 Location of Kilnsey 1 and 2 coaxial systems.

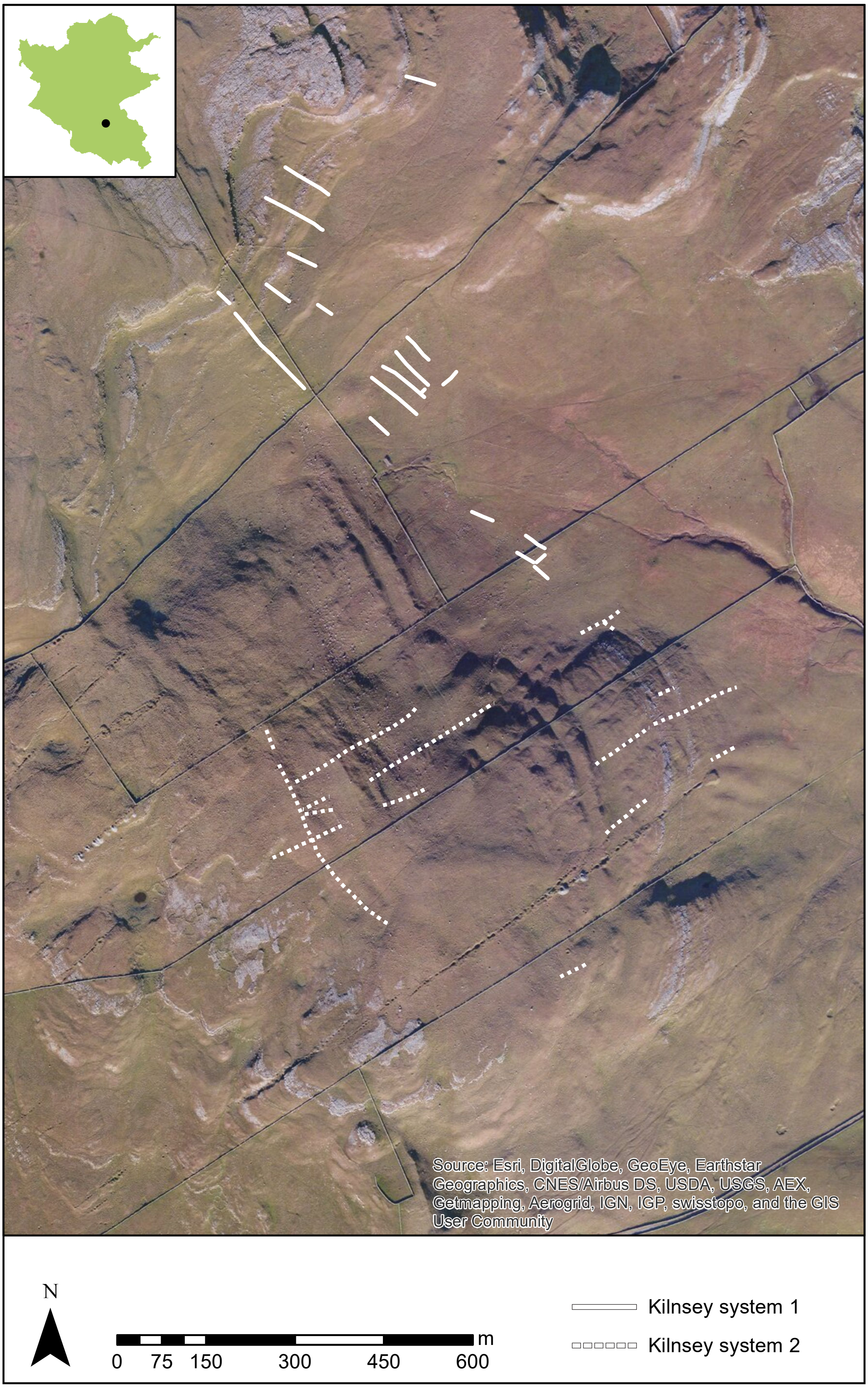


Fig. 4.61 Kilnsey 1 and 2 coaxial boundaries in geographical context.

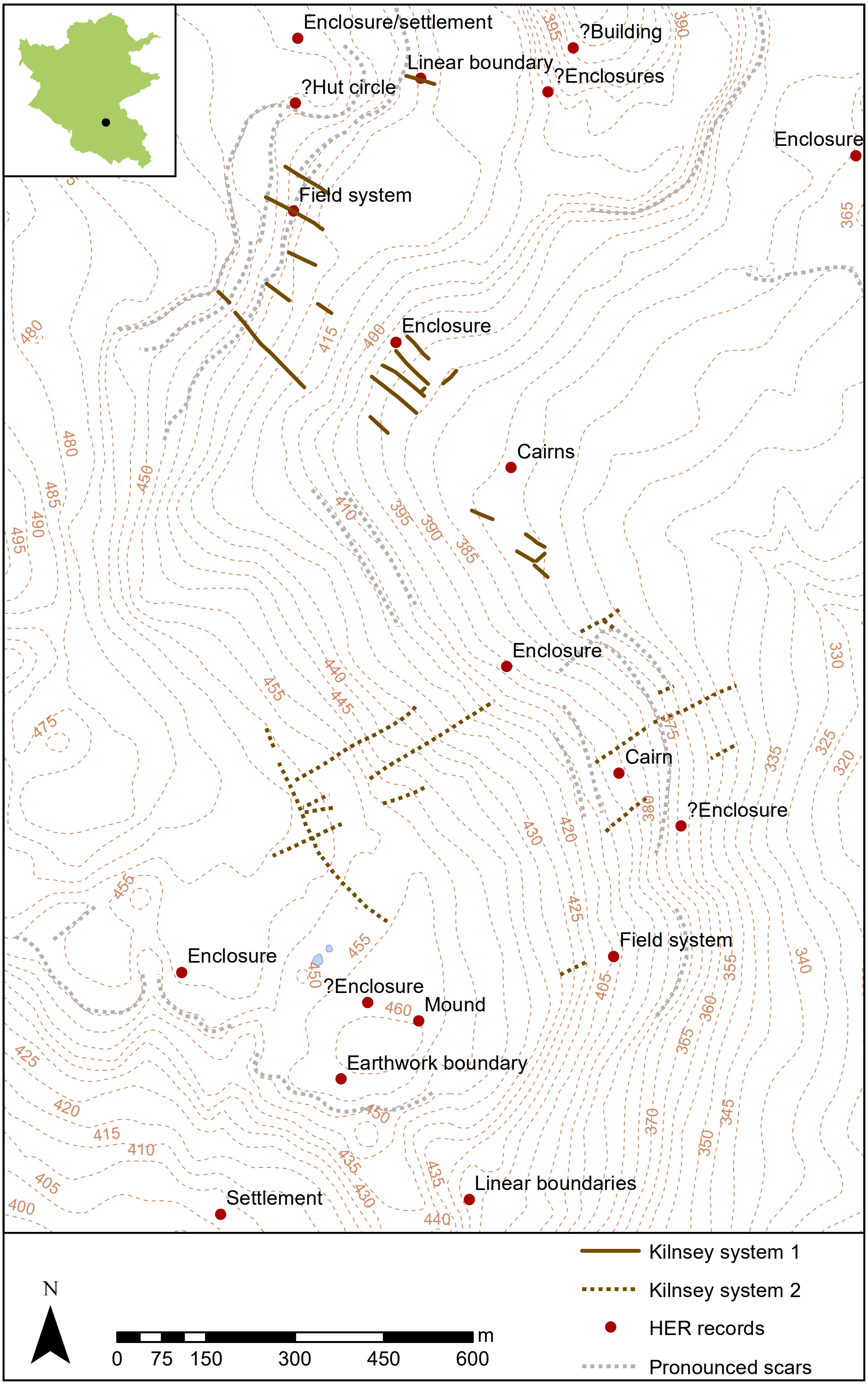


Fig. 4.62 Kilnsey 1 and 2 coaxial systems in relation to features/finds known from the HER.

These boundaries are located on the western side of Wharfedale, below its confluence with Littondale, directly west of (although not visible from) Grassington-Kettlewell Systems 3, 4 and 4a. West of Kilnsey Crag and quarry, the underlying Garsdale and Danny Bridge limestones form a shallow ‘bowl’ separated from the main valley, approximately 1.6-2km in diameter and overlain by till in the lower areas, which creates the catchment area of Howgill. The coaxial systems are located on the western slopes of this bowl, running approximately perpendicular to the contours. This area is currently used as rough grazing and the ancient fields lie within more recent enclosure plots. There is evidence for historic mineral working nearby.

The boundaries appear to fall into two groups and are considered here as separate systems, although the exact relationship between them is not known. Kilnsey 1 consists of five (or six) regularly spaced, low rubble boundaries running northwest-southeast across several low scars; what appear to be some of the same boundaries, albeit with roughly half the distance between each, continue after a gap of around 100m. Further fragments are found approx. 180m to the southeast, such that the system covers a total probable area of around 19ha. It is worth noting that Dowkerbottom Cave, with its flowstone formations and prehistoric burials (Denny 1859) is nearby (just off fig. 4.64 to the north).

Kilnsey 2 covers a larger area. Its axis runs southwest-northeast, with at least 2 axial boundaries terminating at an upper terminal boundary that runs along the contour. A third axial boundary seems to run over the terminal and continue for a further *c.*75m. A further group of boundaries, roughly 250m to the east have been included in Kilnsey 2 due to the similarity of their axis, although the remains in this area are more complex and appear to be overlain by ?medieval land boundaries on a contrasting alignment.

While the HER records the presence of a coaxial system on the northeastern side of this topographical 'bowl', this is not picked up by the YDMP, nor is it visible on the available aerial imagery (see Appendix 2).

4.5. The Littondale systems

4.5.1 Littondale

Fig. 4.63 View from the Halton Gill coaxial system, looking southeast down Littondale towards Wharfedale.

Running northwest-southeast, the glaciated U-shaped valley of Littondale is a tributary of Wharfedale and joins the latter to the north of Kilnsey. Like Wharfedale, Littondale is carved out of various limestones, with Yoredale series rocks outcropping on the upper slopes. The valley sides are very steep in places, with extensive areas of exposed limestone, such as Blue Scar, and horizontal bedding resulting in a stepped profile. Two main tributary gills are present, which run into Littondale from the southwest, and contain Cowside Beck and Hesleden Beck respectively; both are steep-sided V-shaped valleys, offering routes over to Malham Tarn and Ribblesdale. The valley contains evidence of extensive agricultural activity and settlement along the springline, with Iron Age and Romano-British sites at Dawson Close (Pen-y-ghent Gill), Thornber Barns, New Ing Barn and Halton Gill having been the subject of EDM survey and excavation by Manchester University (Maude 1999).

4.5.2 Halton Gill

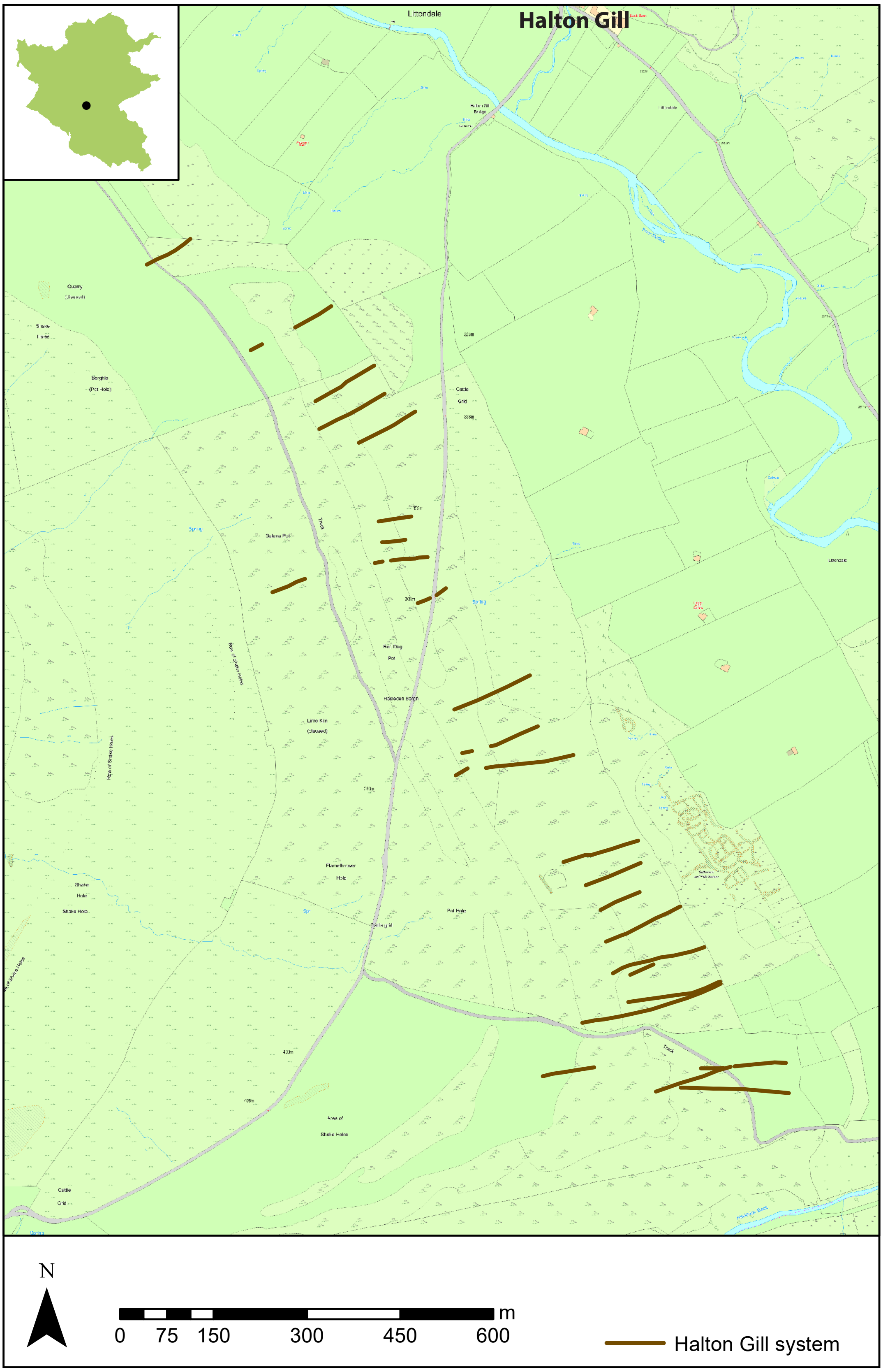


Fig. 4.64 *Location of Halton Gill coaxial system.*

Fig. 4.65 Halton Gill coaxial boundaries in geographical context.

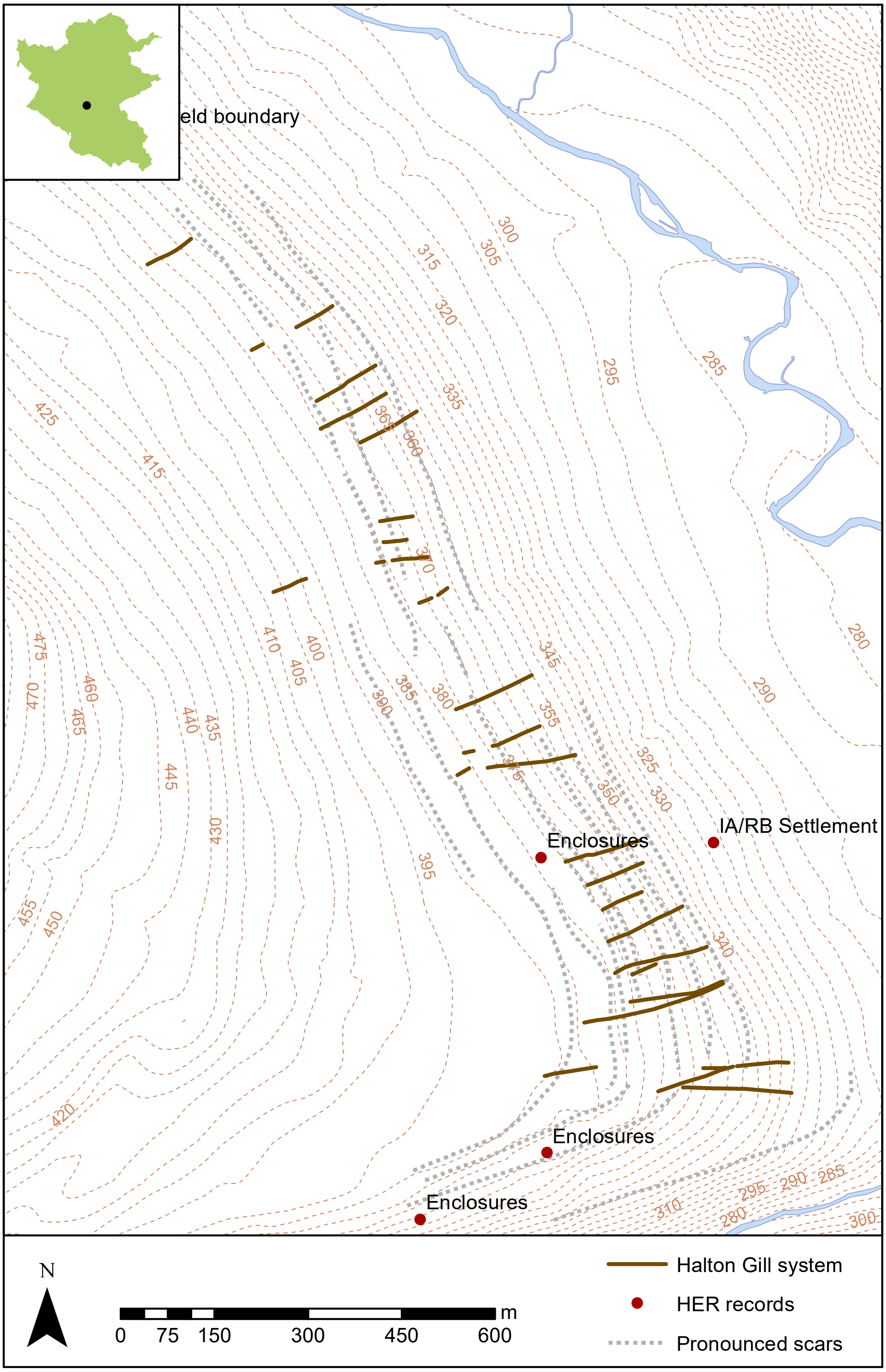


Fig. 4.66 Halton Gill coaxial system in relation to features/finds known from the HER.

Fig. 4.67 Aerial view of Littondale looking northwest towards Halton Gill, showing the Halton Gill coaxial system and Romano-British settlement evidence alongside medieval and post medieval agricultural remains on the valley floor. Photo: YDNPA ANY281-5.

Halton Gill coaxial system is located to the south of the hamlet of Halton Gill, close to the head of Littondale. It is situated on the southwestern side of the main valley, on a spur of Plover Hill to the north of Pen-y-ghent Gill. The underlying geology here is Alston and Danny Bridge limestone. The area is currently used as rough pasture and includes areas of cropped grass, heather and limestone pavement; at the time of visiting, long vegetation severely limited archaeological visibility.

The presence of transverse boundaries is difficult to determine from aerial imagery, due to the texture created by the horizontal bedding of the limestone, although these natural features may serve divisional purposes. Similarly, the upslope end of the system appears to fade out around a low scar, which may act as a terminal boundary. At the southern end of the system, several holloways and at least two banked track/droveways lead up the valley sides. The system is also bisected approximately halfway along its length by a further droveway (approximately 10-20m across with banked sides) that runs down into the valley.

This system is unusual in that the coaxial boundaries run downslope from the 'shoulder' of the valley side and can be traced in places through the remains of more intensive land use on the lower valley side. Excavation of the remains of a farmstead located within this system indicates a late third-century date (Maude 1998: 44-45), although the structures investigated - the retaining wall of the main lynchet and the adjoining enclosure - do not necessarily have a direct association to the, probably earlier, axial boundaries.

4.5.3 Cowside Beck

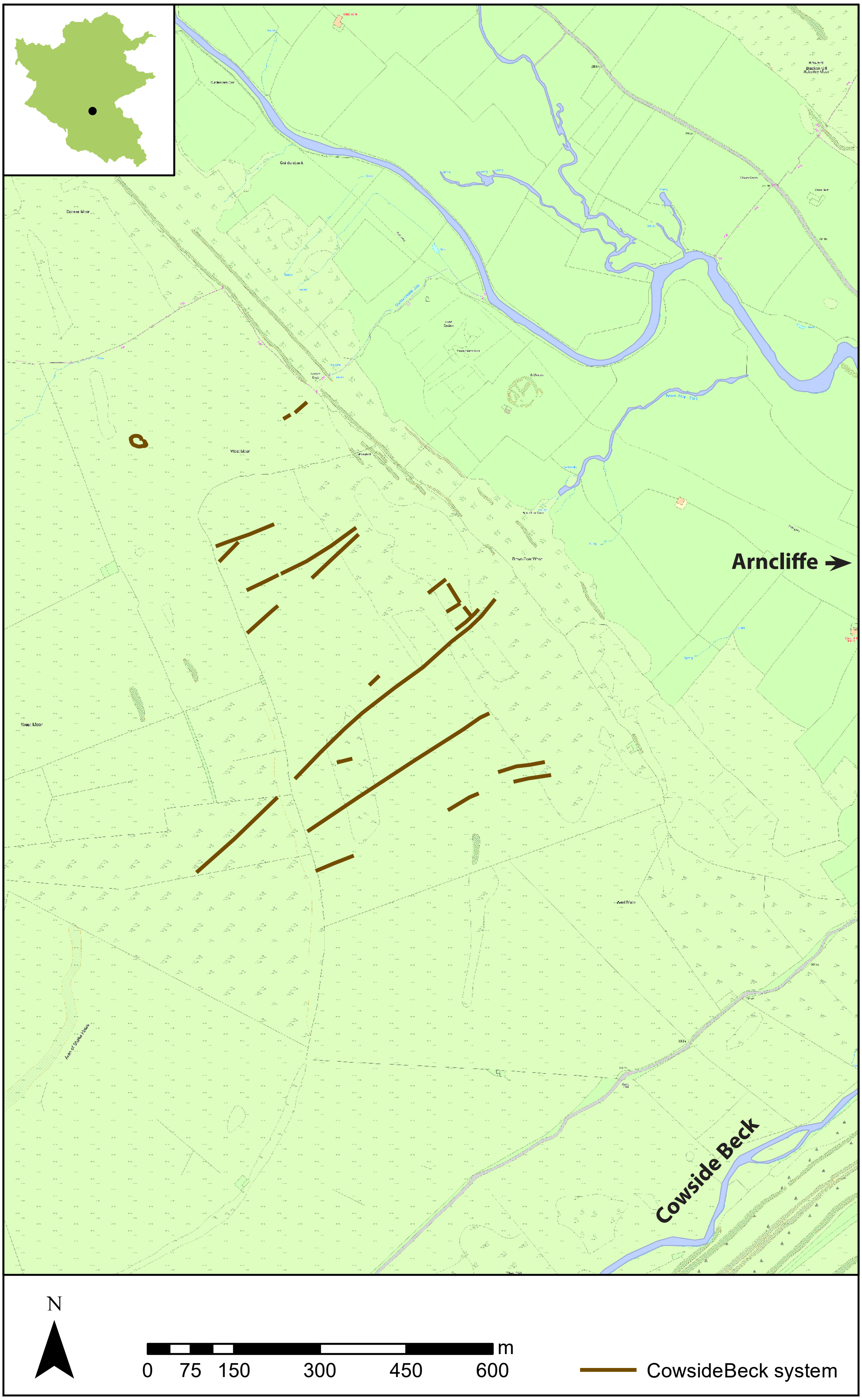


Fig. 4.68 Location of Cowside Beck coaxial system.

Fig. 4.69 Cowside Beck coaxial boundaries in geographical context.

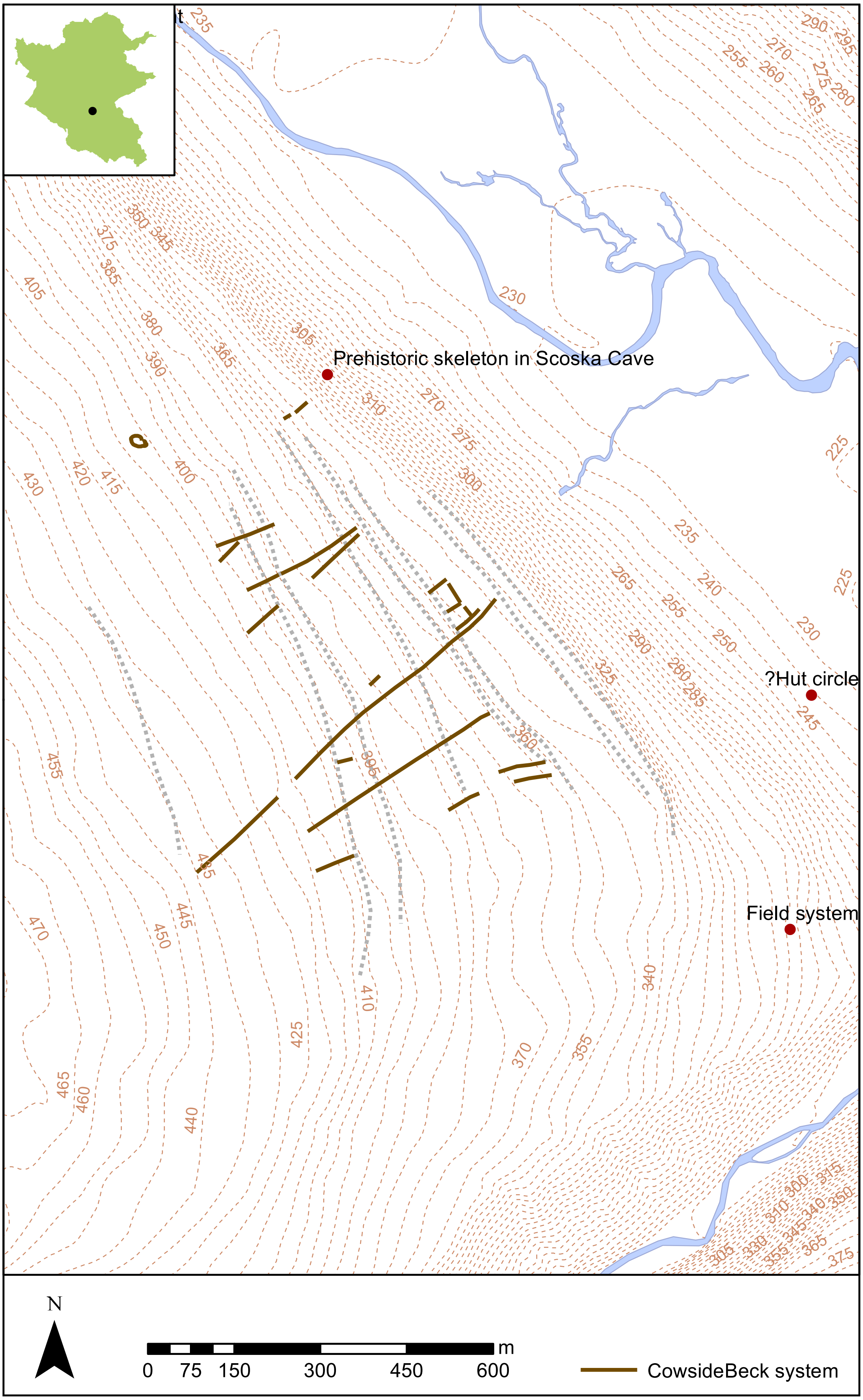


Fig. 4.70 Cowside Beck coaxial system in relation to features/finds known from the HER.

Cowside Beck flows through a steep-sided V-shaped gill to join Littondale and the River Skirfare at Arncliffe. The gill provides a convenient passage way over to Ribblesdale, via Malham Tarm. This field system is located on the main dale side to the northwest of the beck, on the slopes of West Moor. Several types of limestone make up the valley sides at this point, with bands of Yoredale sandstone outcropping upslope of the field system. The land has been enclosed in modern times and is used as rough grazing; in places the limestone is almost bare.

Covering an area of approximately 48ha, this system is less coherent and less well preserved than others, containing potentially overlapping boundaries on slightly different alignments, suggesting phases of reuse. To the southeast of the field system, in the angle created between the valley side and Cowside Beck, the scar line gives way to more gentle contours, which are exploited by several braided holloway routes. These appear to provide access to higher grazing from a complex of square fields and lynchets believed to be of Romano-British and later date. There is also settlement evidence within the area of the coaxial field system, in the form of stone/earthworks, although it is of unknown date. To the north, human remains (presumed prehistoric) were found in Scoska Cave in 1905 and finds from the surrounding scree include a Neolithic flint scraper and Roman coin (*c.*AD 270) (Maude 1998: 43).

4.5.4 Arncliffe

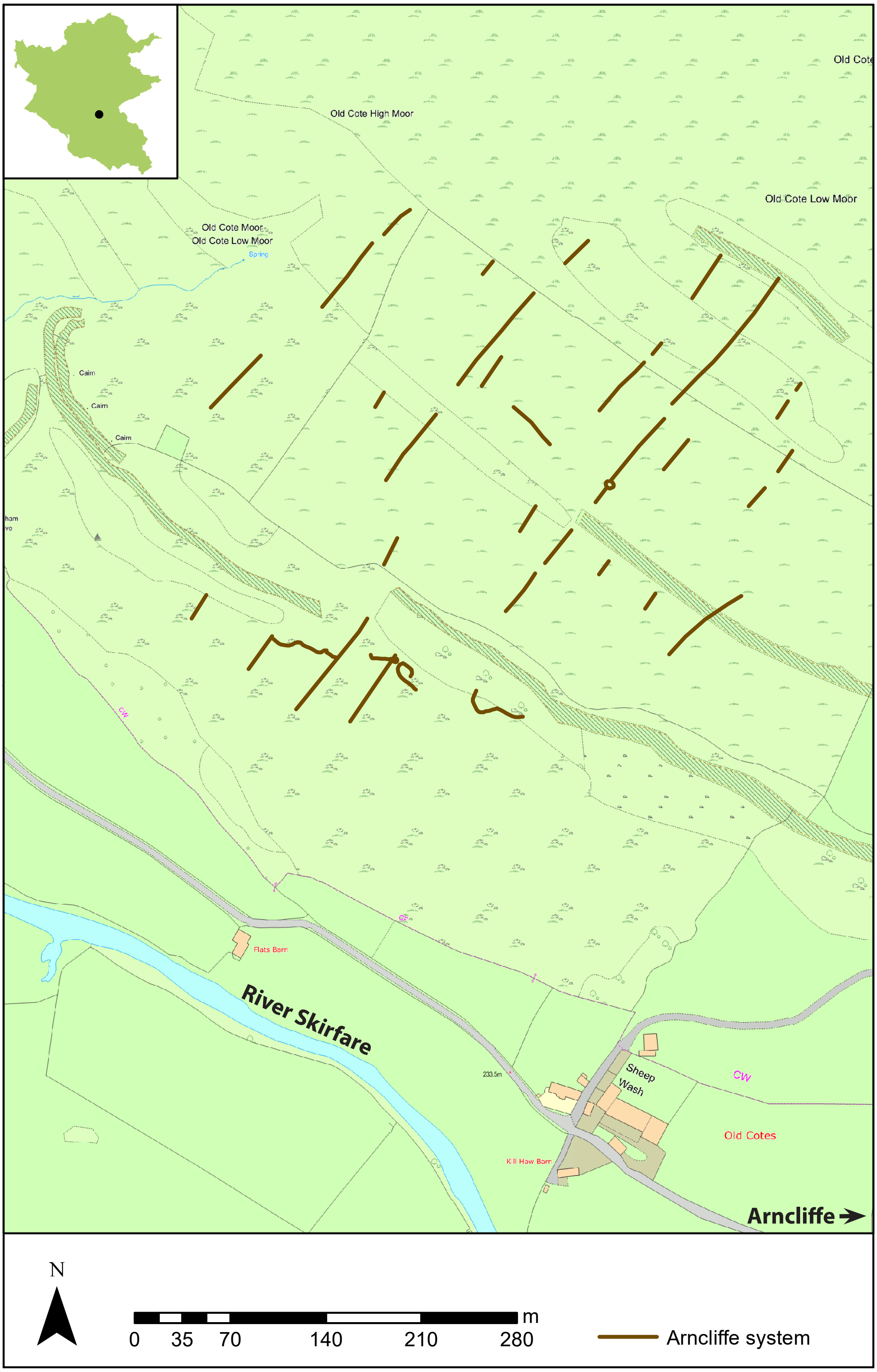


Fig. 4.71 Location of Arncliffe coaxial system.

Fig. 4.72 Arncliffe coaxial boundaries in geographical context.

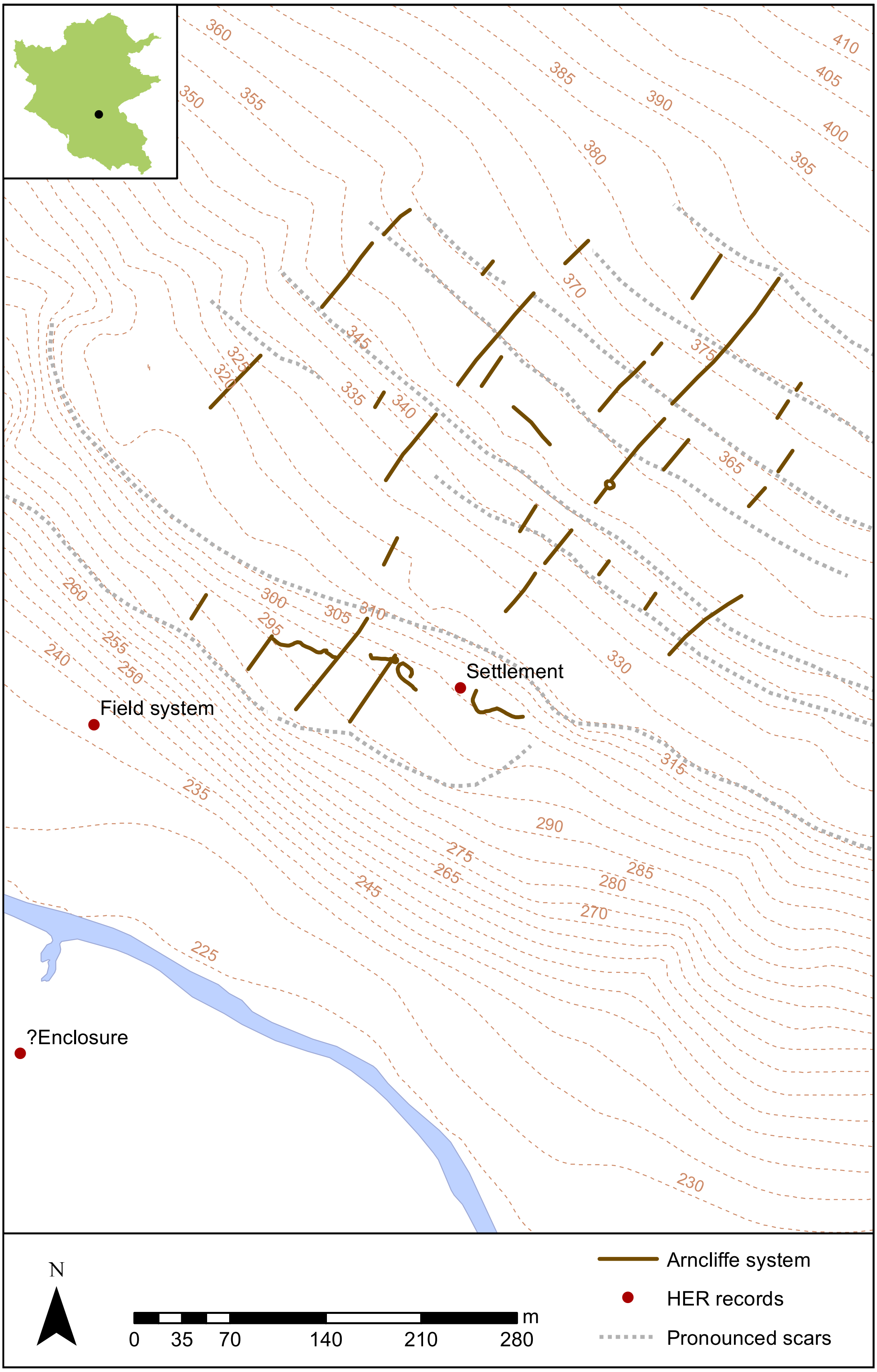


Fig. 4.73 Arncliffe coaxial system in relation to features/finds known from the HER.

Fig. 4.74 Aerial view of Arncliffe coaxial system, looking west from above Old Cote Moor. Photo: YDNPA YDP081-19.

This field system is located on Old Cote Low Moor, on the southwest facing side of the valley, northwest of the village of Arncliffe; this hillside also forms the southwestern flank of Knipe Hill. A number of small scars run along the contour, causing a stepped profile between the valley floor and the upper part of the hillside, where the enclosed rough grazing land gives way to Old Cote Moor.

More than 30 individual segments of boundary can be identified on the hillside, compartmentalizing land already divided up by the natural scars; there is no evidence of artificial transverse boundaries. In a number of places, the axial boundaries continue above/below the scars, resulting in the appearance of four dominant, evenly spaced, parallel boundaries that run almost the whole length of the system, with more fragmented remains between them. The coaxial system is contained to the northwest by a stream and to the southeast by a slight but nevertheless distinct dry gill. Both upslope and downslope extremities appear to be marked by scar lines rather than terminal boundaries as such. Various settlement remains are recorded within the coaxial system, frequently located below the scar lines, particularly in the downslope portion of the system. The aerial imagery shows a possible small circular enclosure incorporated into one of the axial boundaries.

4.6 The Ribblesdale systems

4.6.1. Ribblesdale

Fig. 4.75 View north up Ribblesdale from above Settle. Photo: author.

Ribblesdale runs approximately north-south on the southwestern side of the National Park. Although not so clearly U-shaped as Wharfedale and Littondale, Ribblesdale demonstrates an obviously glaciated landscape of moraines, erratics, drumlin fields and scoured limestone scars. The highest peaks of the National Park form the upper parts of the valley. The limestone also contains a particularly high density of caves.

4.6.2 Horton

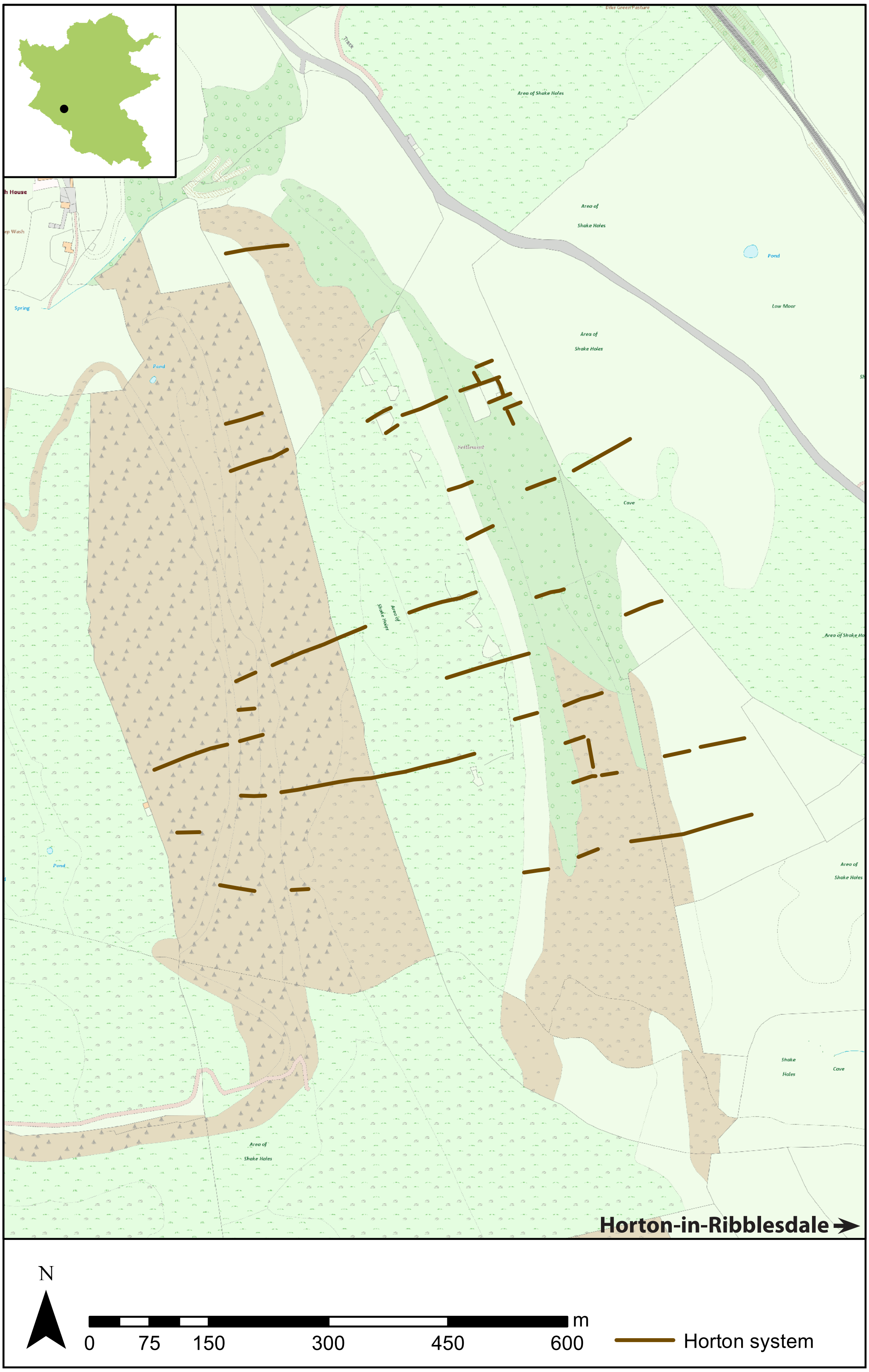


Fig. 4.76 Location of Horton coaxial system.

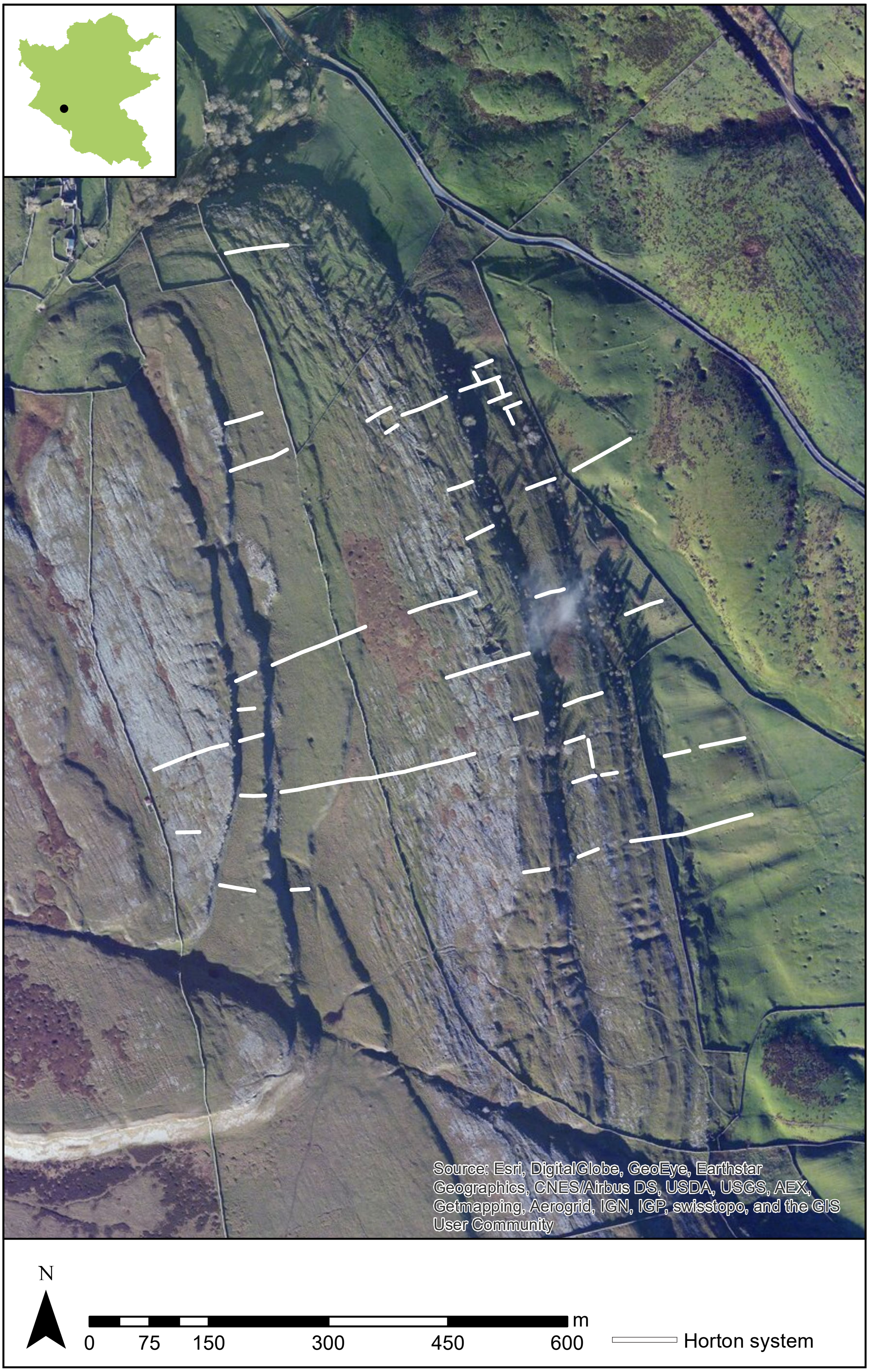


Fig. 4.77 Horton coaxial boundaries in geographical context.

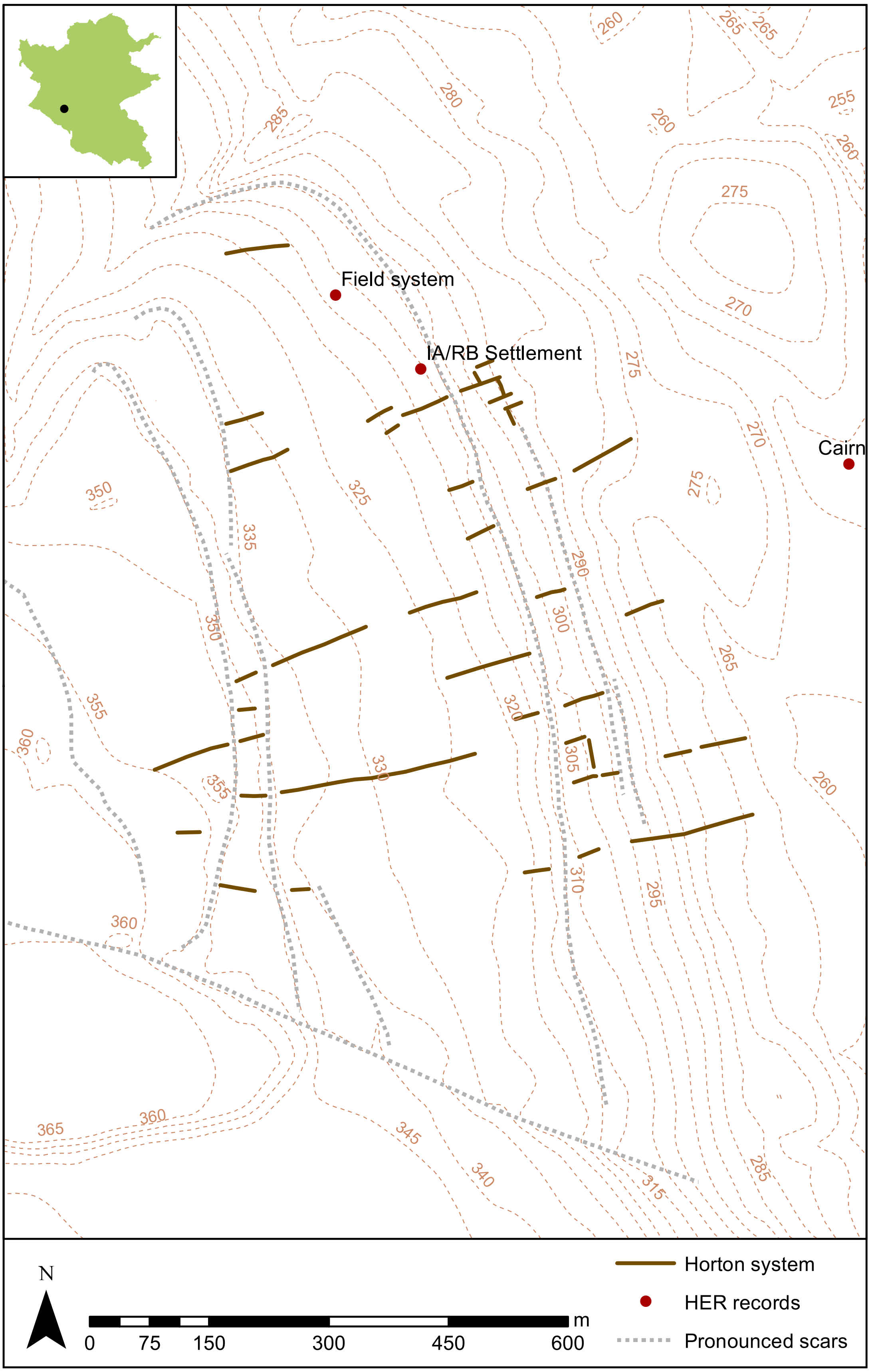


Fig. 4.78 Horton coaxial system in relation to features/finds known from the HER.

Fig. 4.79 The boundaries of the Horton coaxial system are slight, very difficult to make out on the ground and, on an overcast day, even more difficult to photograph. This one runs towards the camera, between the tips of the two arrows.

This system is located on The Sulber, pasture approx. 1.5km northwest of Horton in Ribblesdale and north of Horton Quarry. The underlying rock is Danny Bridge limestone, which forms broad terraced steps. The land is used as rough pasture, large areas of which are now limestone pavement. To the south of the field system a discrete fault line, Sulber Nick, runs northwest-southeast across the hillside into Ribblesdale; no boundaries are apparent to the south of this, although extensive quarrying may have removed the evidence. To the north, a small gill provides a possible topographic boundary to the system.

The system covers an area of around 49ha, running approximately 850m along the hillside and 700 across the contour, and appears relatively cohesive in terms of preservation. The view from the system is extensive, both up and down the dale, but is dominated by the distinctive silhouette of Pen-y-ghent to the east. While apparent from the aerial imagery, the boundaries themselves are slight and less obvious on the ground than in other parts of the Dales. Numerous possible clearance cairns (not detailed on the HER), which may be associated with the coaxial system, were identified on the broadest terrace. Iron Age/Romano-British settlement is recorded by the HER among the lower slopes of the coaxial system, although this has not been investigated further and it is not known if it is associated.

4.6.3 Stainforth

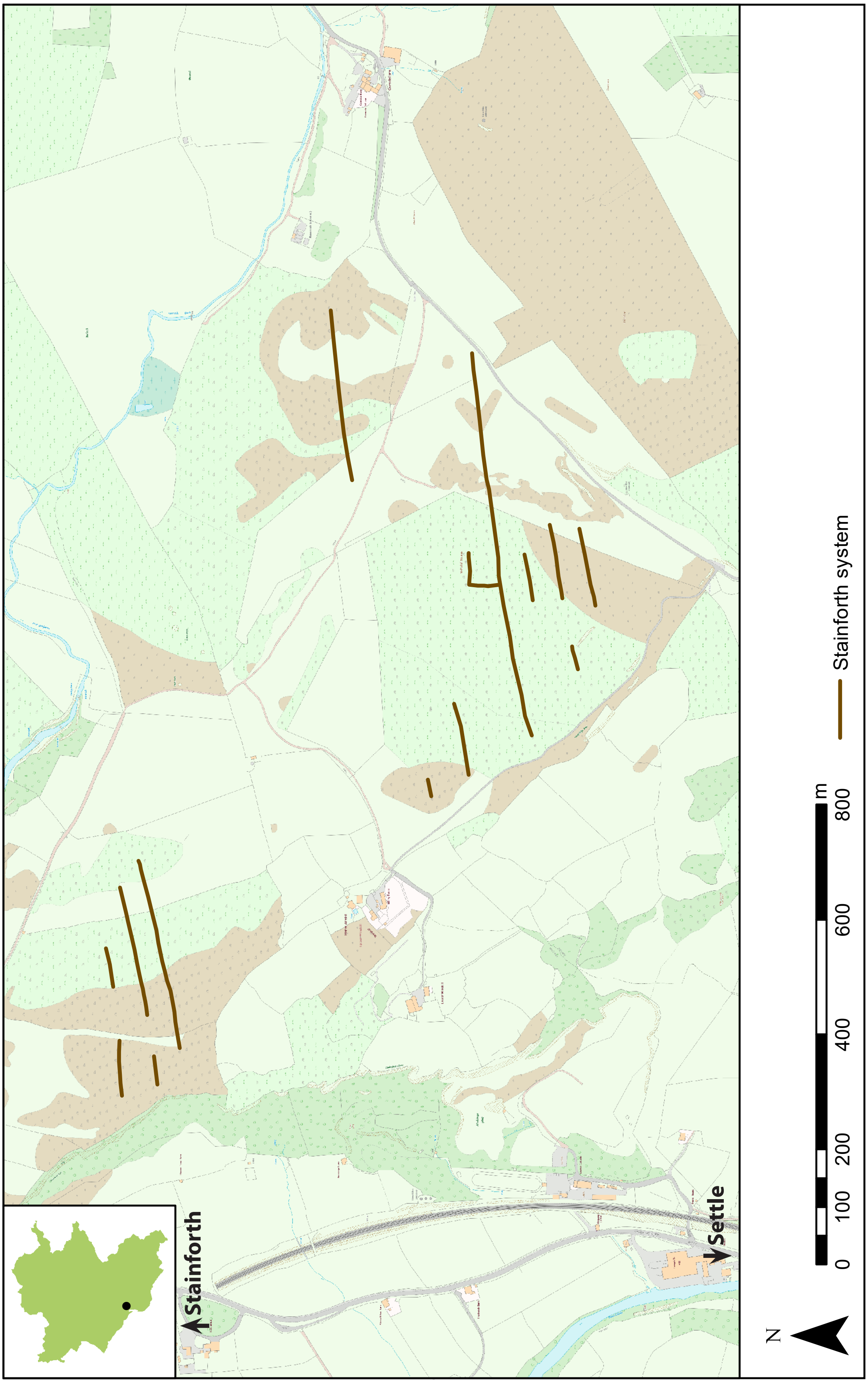


Fig. 4.80 Location of Stainforth coaxial system.

Fig. 4.81 Stainforth coaxial boundaries in geographical context.

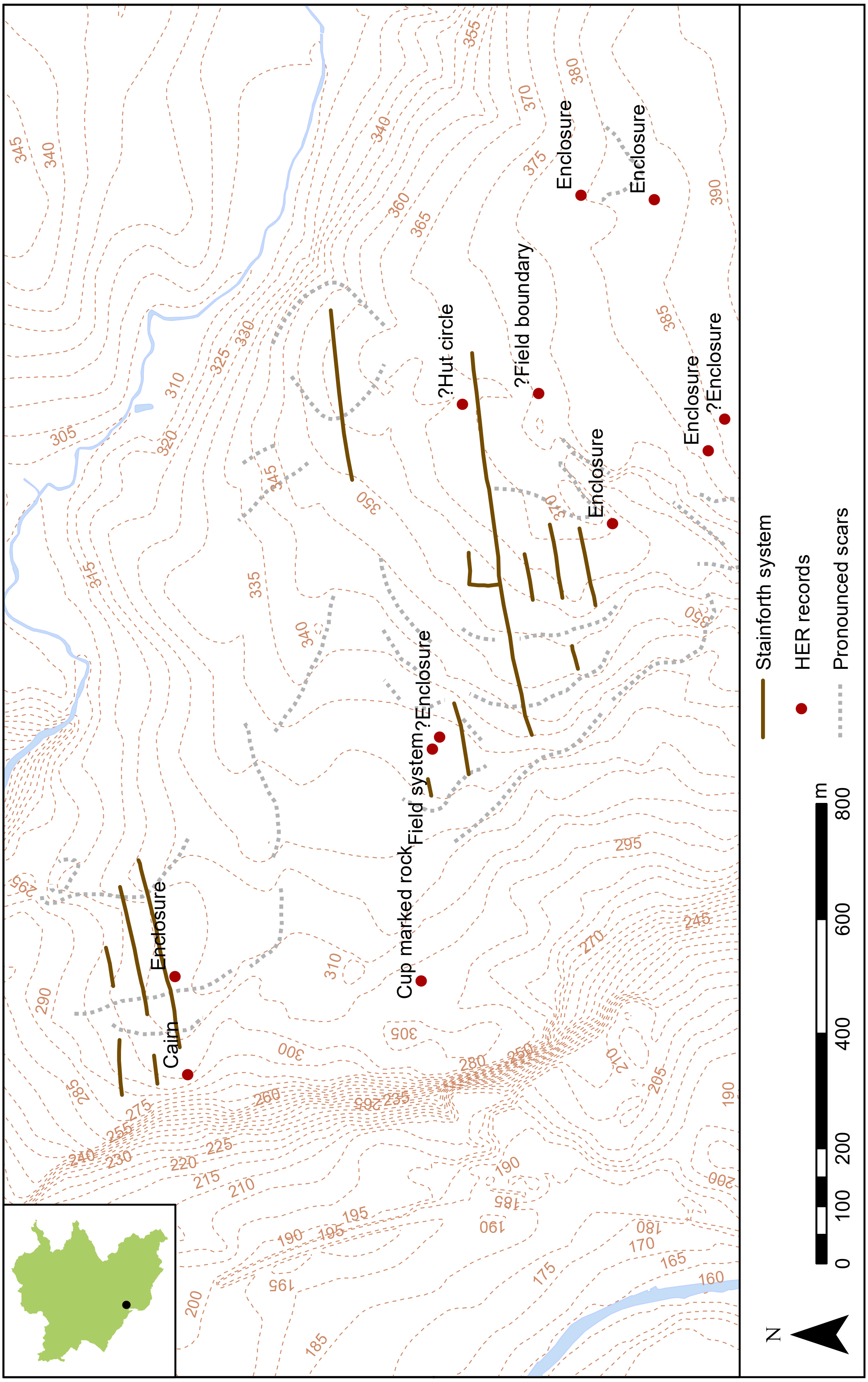


Fig. 4.82 Stainforth coaxial system in relation to features/finds known from the HER.

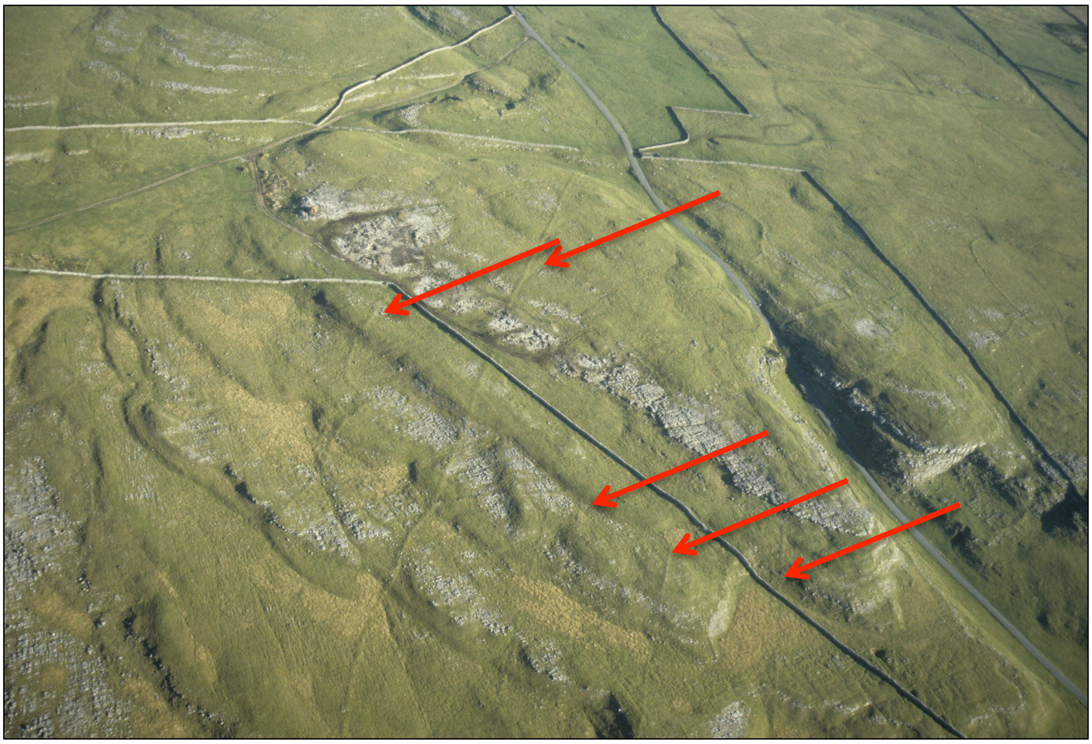


Fig. 4.83 Aerial view of Winskill Stones, looking east. Main axials marked. Photo: YDNPA YDP2-04.

This system is located approx. 2.5km north of the Settle system, on Winskill Stones and the top of Stainforth Scar, southeast of the village of Stainforth. The system comprises two groups of boundaries: although the relationship between them is unknown, they share the same alignment, characteristics and approximate separation between boundaries. The two groups are separated by an area of improved pasture and are treated together here in view of the possibility that they may have originally formed parts of the same system. It may be relevant that one of the current boundaries within this area of improved pasture also shares the alignment of the coaxial system.

Situated on Kilnsey, Garsdale and Danny Bridge limestone partially covered by till, the land is currently used as pasture. While sloping more gently to the south and east, the land drops away to Stainforth Beck to the north and the River Ribble to the southwest. The longest and most clearly visible boundary is detectable on the aerial photograph for around 700m before it being lost under the modern road and improved pasture. The aerial imagery also suggests the possibility of artificial transverse boundaries. Visibility is currently hampered on the ground due to long grass and areas of particularly uneven limestone pavement, but a number of glacial erratics were noticed, including one particularly prominent example on a limestone pedestal, widely known as Samson's Toe. These 'out of place' greywacke stones, distinguished from the limestone by their colour and texture as well as their colonisation by a distinctive green lichen, may have held significance for the prehistoric boundary builders (although they do not show alignment with the axial boundaries).

4.6.4 Settle

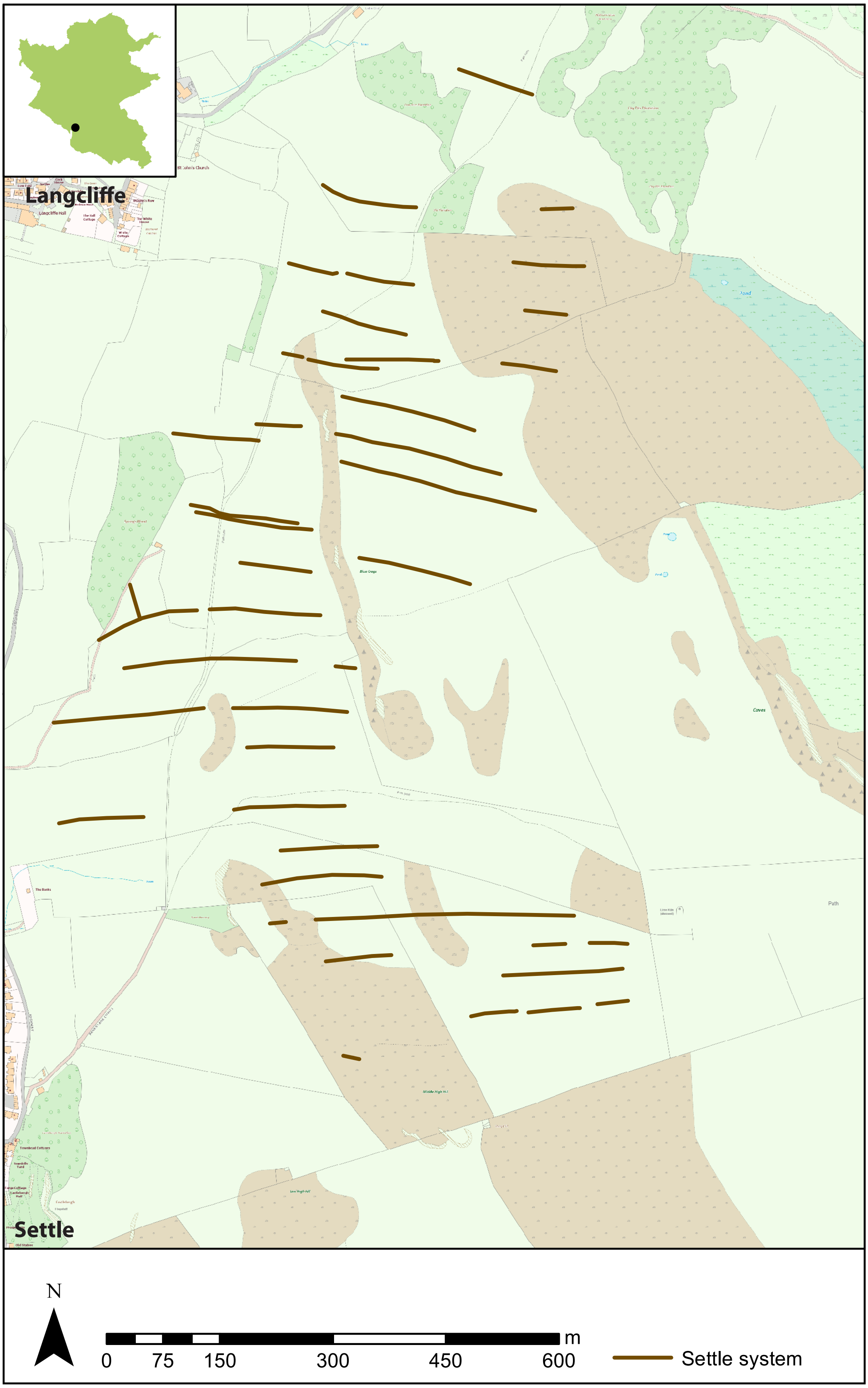


Fig. 4.84 Location of Settle coaxial system.

Fig. 4.85 Settle coaxial boundaries in geographical context.

Fig. 4.86 Settle coaxial system in relation to features/finds known from the HER.

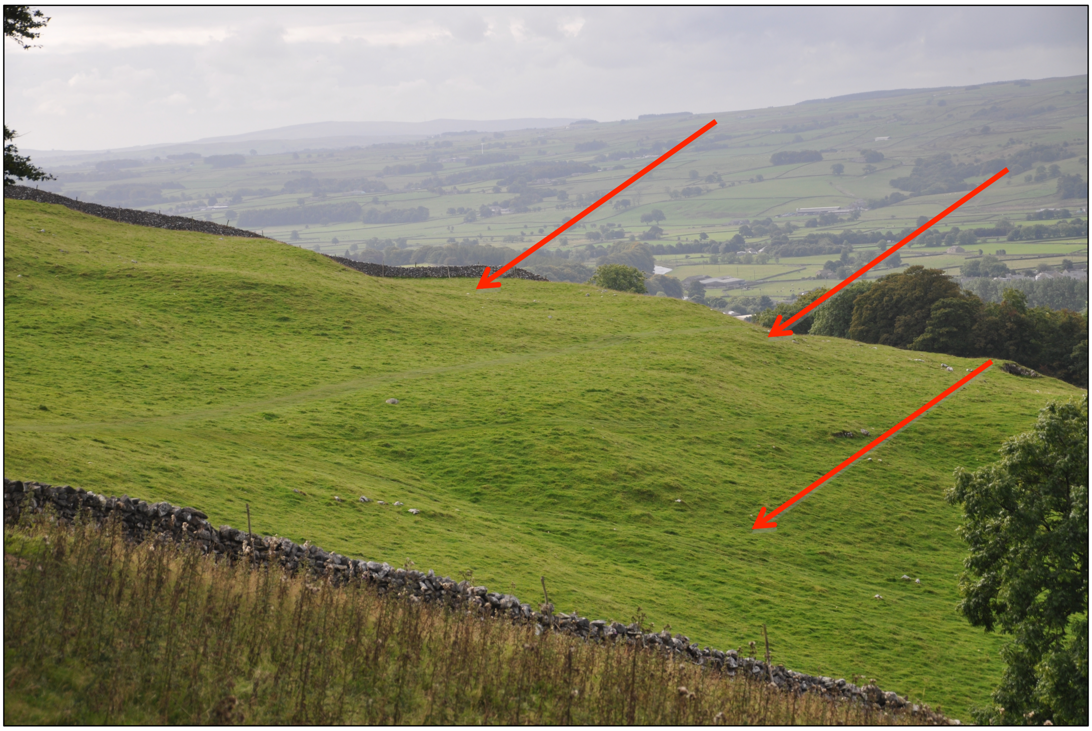


Fig. 4.87 Axial boundaries of the Settle system within later improved pasture. Photo: author.

This system is located on the higher ground to the immediate northeast of Settle. Situated on Garsdale and Danny Bridge limestone partially covered with till, this land forms part of the west-facing valley side of Ribblesdale and includes low scars and areas of limestone pavement. Current land use is as rough and, in places improved, pasture.

The western extent of the system is difficult to identify as it runs into the medieval plots on the edge of Settle; there is no evidence for a terminal boundary at the eastern edge and boundaries appear to fade out, although this role may have been taken by one or more of the scars that run at right angles to the axial direction of the system. Similarly, there is no evidence for transverse boundaries, however there are several potential dividing scars. The system appears to cover at least 63ha. Settlement is recorded by the HER within and nearby the system, although this has not been investigated thoroughly. The limestone scars to the east contain numerous small caves, and Attermire Scar, just over 1km from the centre of the system, contains the well-known Victoria, Jubilee and Attermire Caves among others (Dearne & Lord 1998; Lord & Howard 2013).

4.7 The Wensleydale systems

4.7.1 Wensleydale

Fig. 4.88 View across Wensleydale showing the broad, open cross section and stepped profile. Photo: author.

Wensleydale is by far the largest and broadest of the Yorkshire Dales - up to 4km wide at its widest point - and feels much less enclosed than other other valleys. It follows the course of the River Ure from west to east with major tributary valleys including Widdale, Sleddale, Bishopdale and Coverdale. The sides of the dale are terraced, due to the differential erosion of the Yoredale Series, though on a much broader scale than elsewhere, and the dale contains numerous classic examples of glaciated geomorphology, including extensive moraines and pronounced drift tails. Despite its size, Wensleydale contains few known coaxial field systems, namely those at Carperby on the north side of Mid-Wensleydale, West Burton at the mouth of Bishopdale, and perhaps at Caldbergh, at the junction of Coverdale and Wensleydale, where the HER records the presence of a coaxial system but thick heather coverage has hampered further investigation. The HER also records a coaxial system above the village of Thoralby, in lower Bishopdale, although there is no visible evidence on the available aerial imagery. It is worth noting that the sites of Carperby and West Burton lie almost opposite each other across the main valley, the floor of which is around 2.8km wide at this point.

4.7.2 Carperby 1

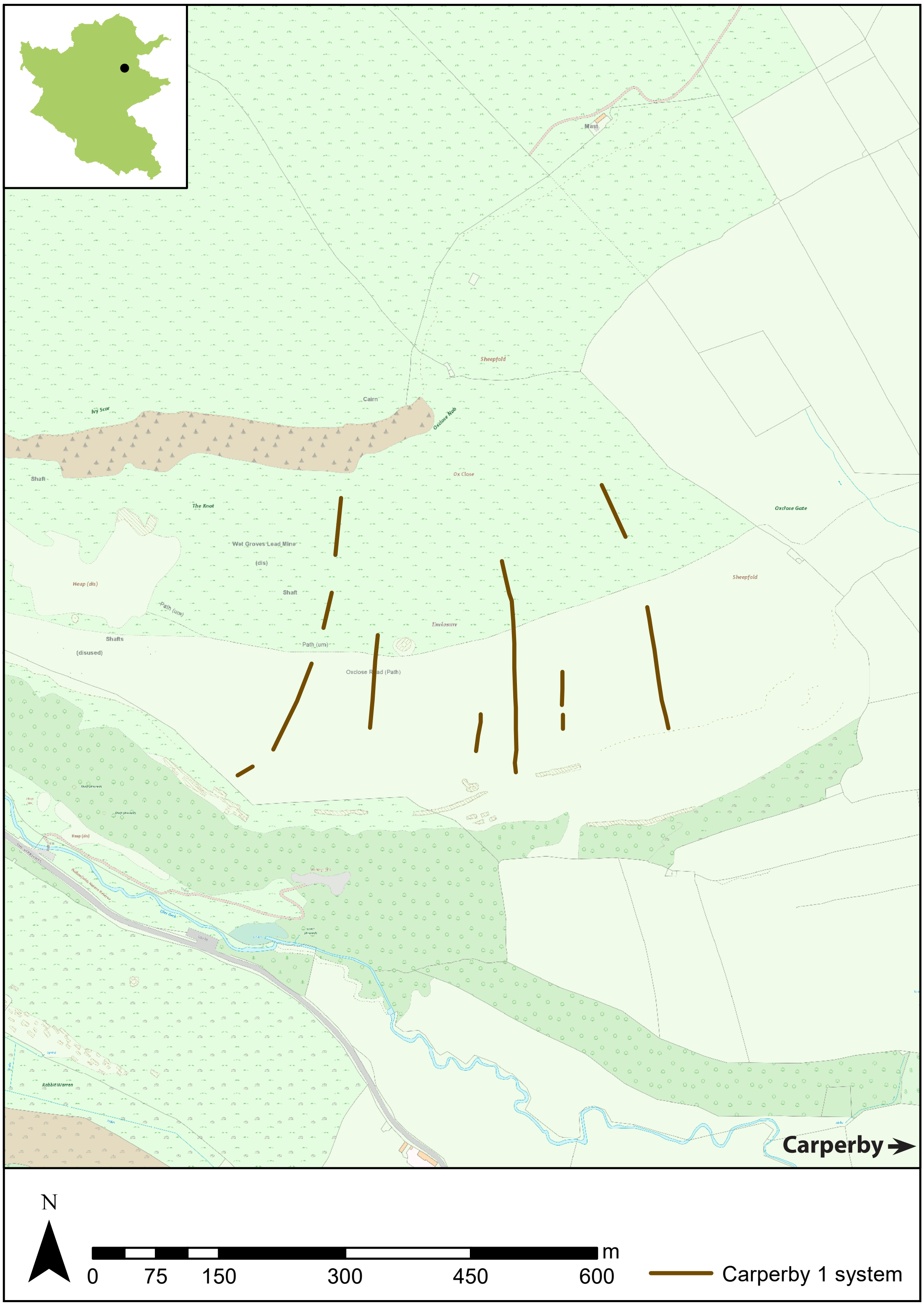


Fig. 4.89 Location of Carperby 1 coaxial system.

Fig. 4.90 Carperby 1 coaxial boundaries in geographical context.

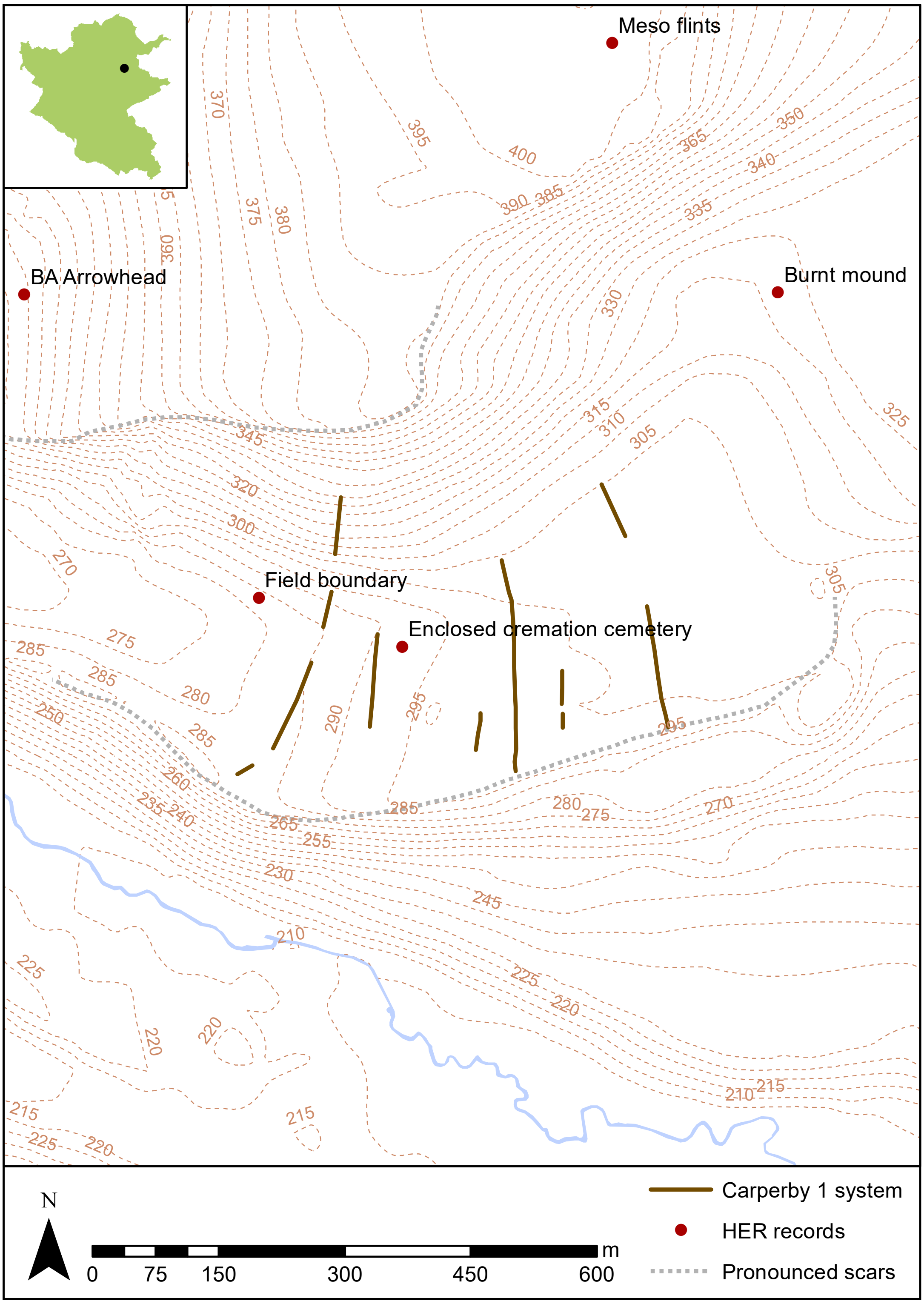


Fig. 4. 91 Carperby 1 coaxial system in relation to features/finds known from the HER.

Fig. 4.92 Axial boundary of Carperby 1 coaxial system, cut by a later lead mining leat.

It is not clear whether coaxial systems Carperby 1 and 2, situated between the villages of Carperby and Woodhall, are in fact parts of the same large system or if the lack of evidence of boundaries over the distance between them (roughly 2km) is ‘real’; they are treated independently here due to the break in the natural scar line that coincides with this gap. This break allows the remains of lynchetted cultivation to encroach higher up the hillside, as well as providing access between higher and lower pastures, as demonstrated by evidence of modern tracks. The terrace on which Carperby 1 is situated continues along the hillside to the east, towards Carperby 2 system, albeit becoming less prominent and well defined. On it, the remains of several occasional boundaries are visible on aerial imagery, possibly indicating the continuation of coaxial systems in this area, although there is also evidence for medieval and later cultivation.

Carperby 1 is located on Ox Close Pasture, on the north side of Wensleydale, on Alston limestone with subordinate sandstone and argillaceous rocks, outcrops of other limestones and Yoredale sandstone. There is evidence of intensive historic lead mining across the area; indeed, the system is situated adjacent to, and may have been truncated by, a large disused lead mine.

The system appears to comprise the remains of six parallel axial boundaries, running perpendicular to the contour, within an area of roughly 17ha. As the valley side curves round, the boundaries are not precisely parallel, but radiate with the curve. The downslope edge of the pasture falls away to the moraines of the valley floor and this drop may act as a terminal for the axial boundaries that run down to it. Upslope, the boundaries appear to fade out around the break of slope of Ivy scar: they may have been robbed for mining work or remain invisible amongst the scree. Those that continue from the flat land onto the slope deviate slightly from their original course at the break of slope. The area of the system is defined to the west by the later lead mine, although it may have continued further, perhaps as far as Eller Beck, which would provide a natural topographic boundary. The HER records a prehistoric field system and settlement adjacent to the beck. To the east of the coaxial system, the boundaries cease to be visible around the break in the scar line noted above. There is no evidence of transverse boundaries in this system. A Bronze Age enclosed cremation cemetery, likely to predate the coaxial boundaries, is located adjacent to one of the boundaries within the system.

4.7.3 Carperby 2

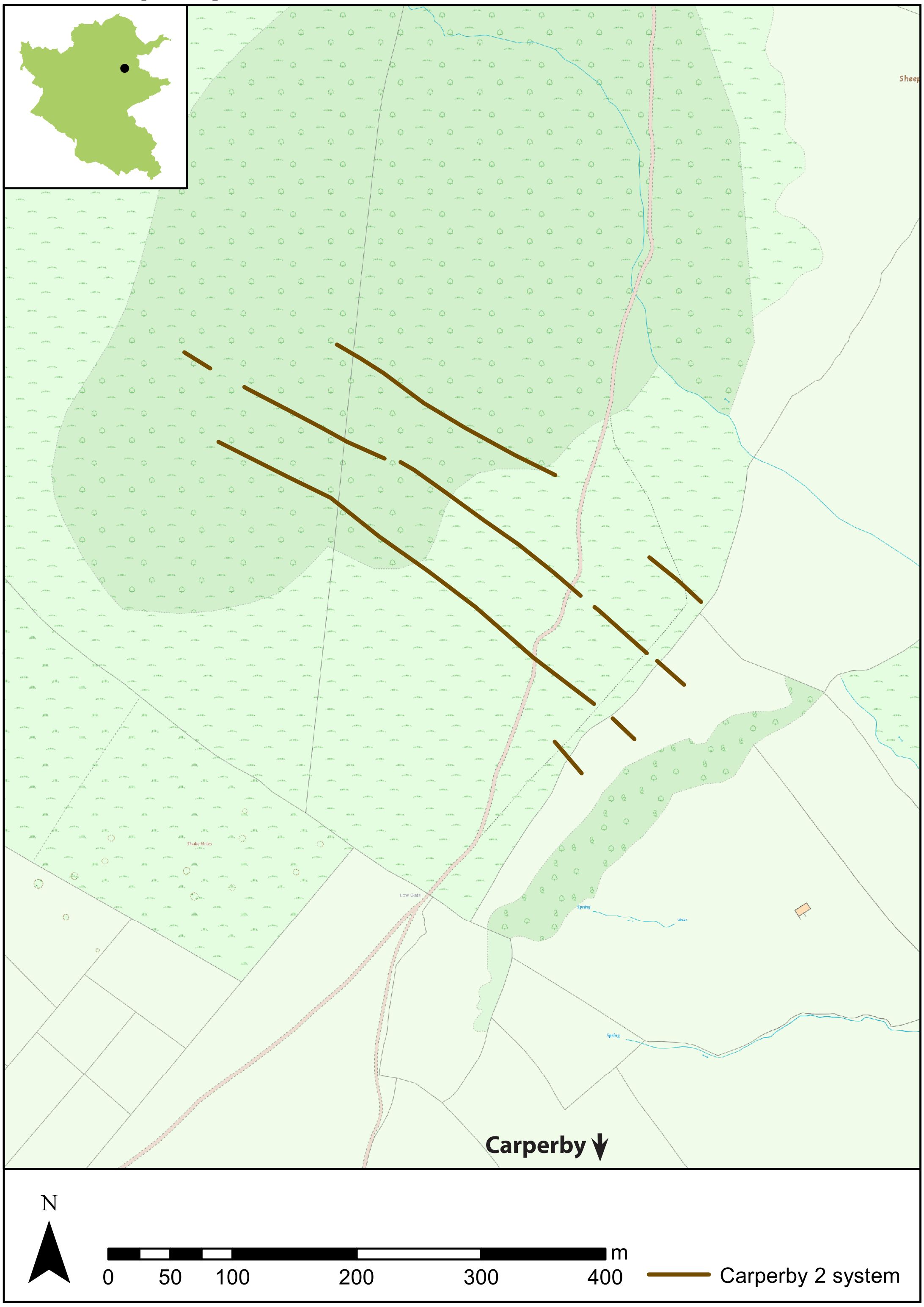


Fig. 4.93 Location of Carperby 2 coaxial system.

Fig. 4.94 Carperby 2 coaxial boundaries in geographical context.

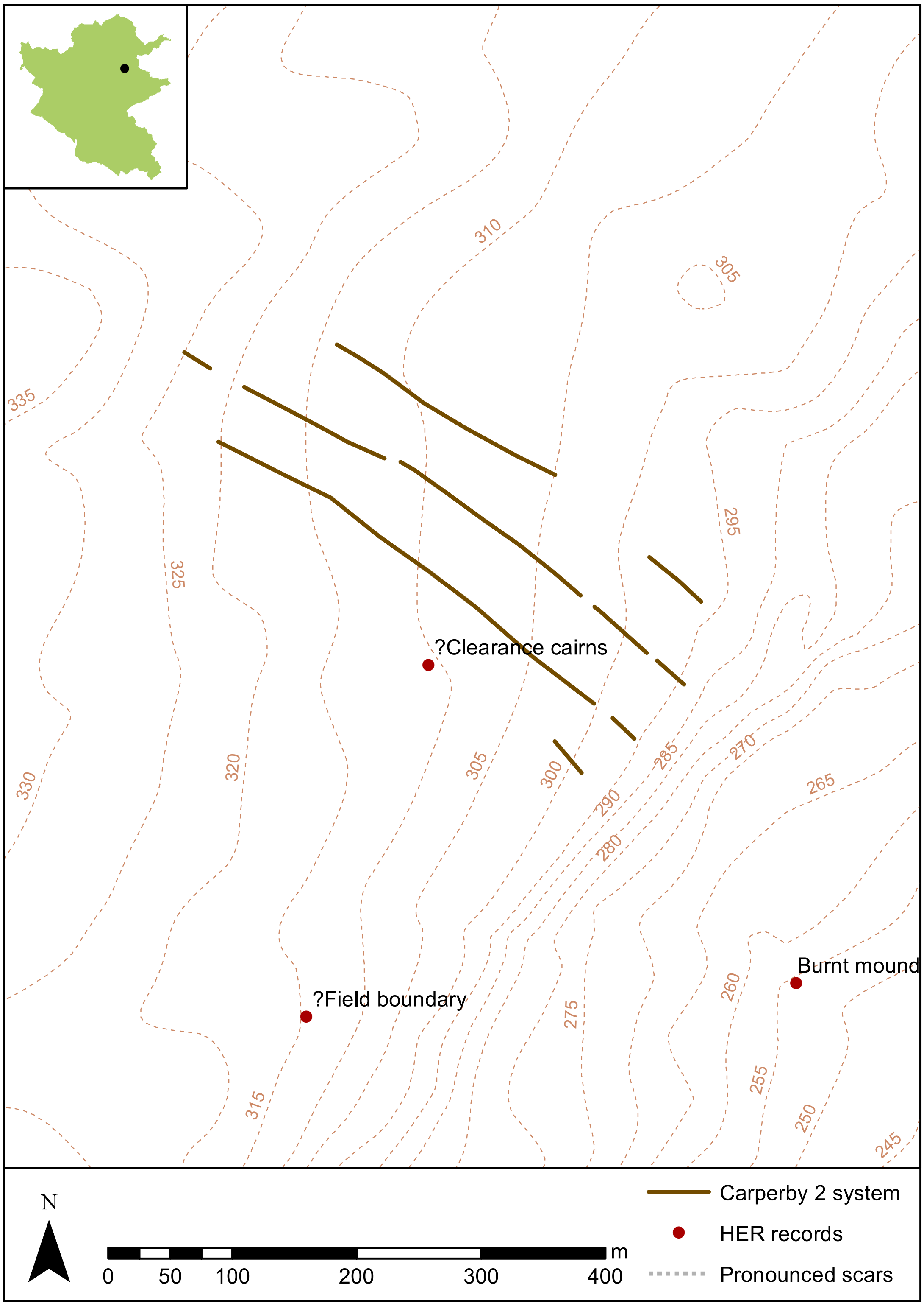


Fig. 4.95 Carperby 2 coaxial system in relation to features/finds known from the HER.

Carperby 2 covers an area of around 9ha to the east of Peatmoor Lane and comprises fragments of several parallel boundaries aligned northwest-southeast, the three longest of which measure roughly 450m and are each separated by approximately 60m. At their upslope end they fade out before reaching Locker Tarn; at their downslope end, the steep slope immediately above the walled pastures appears to represent their terminal. It may be relevant to note that the line of two of the boundaries are continued in modern pasture enclosure walls.

4.7.3 West Burton

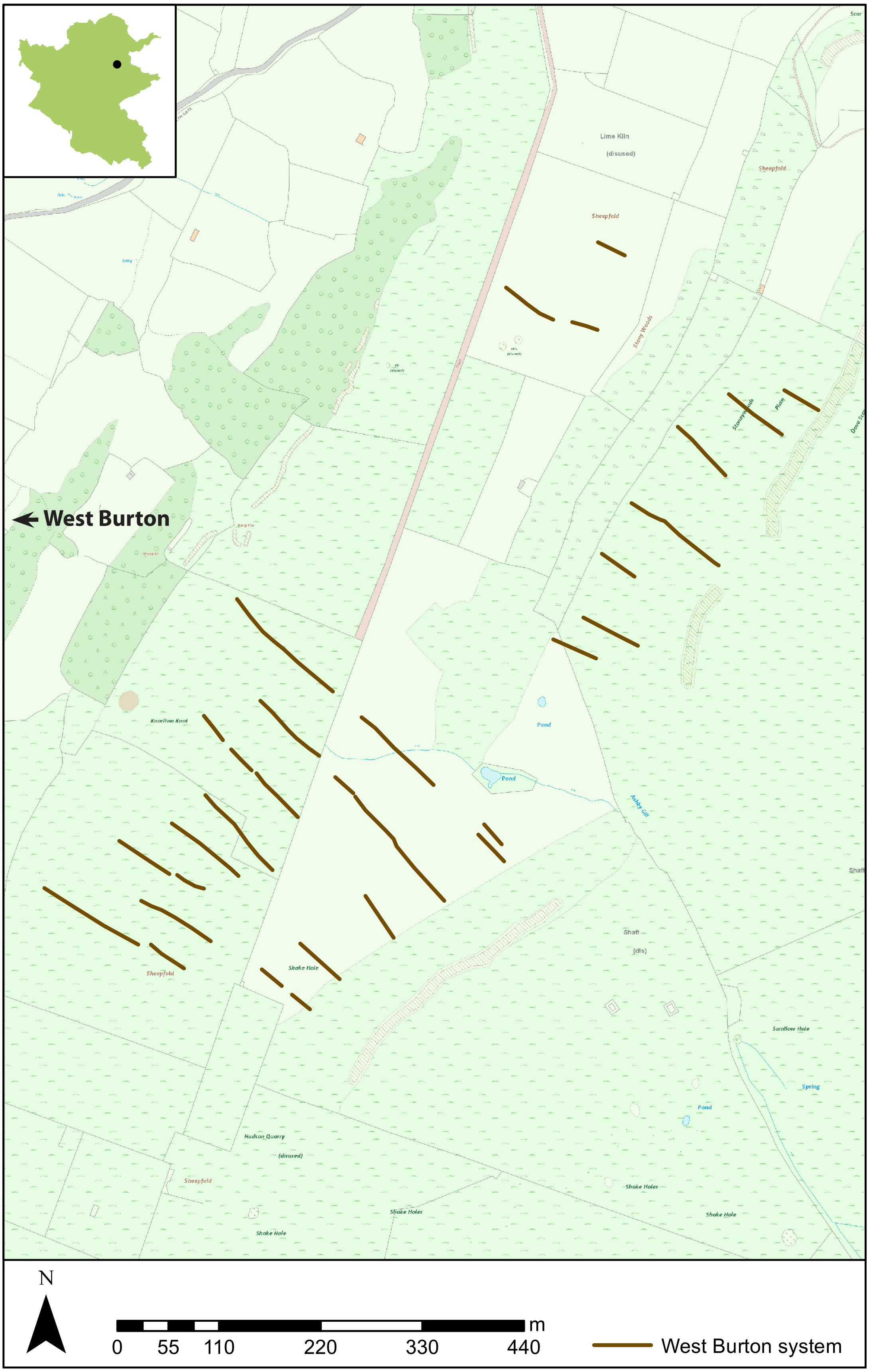


Fig. 4.96 Location of West Burton coaxial system.

Fig. 4.97 West Burton coaxial boundaries in geographical context.

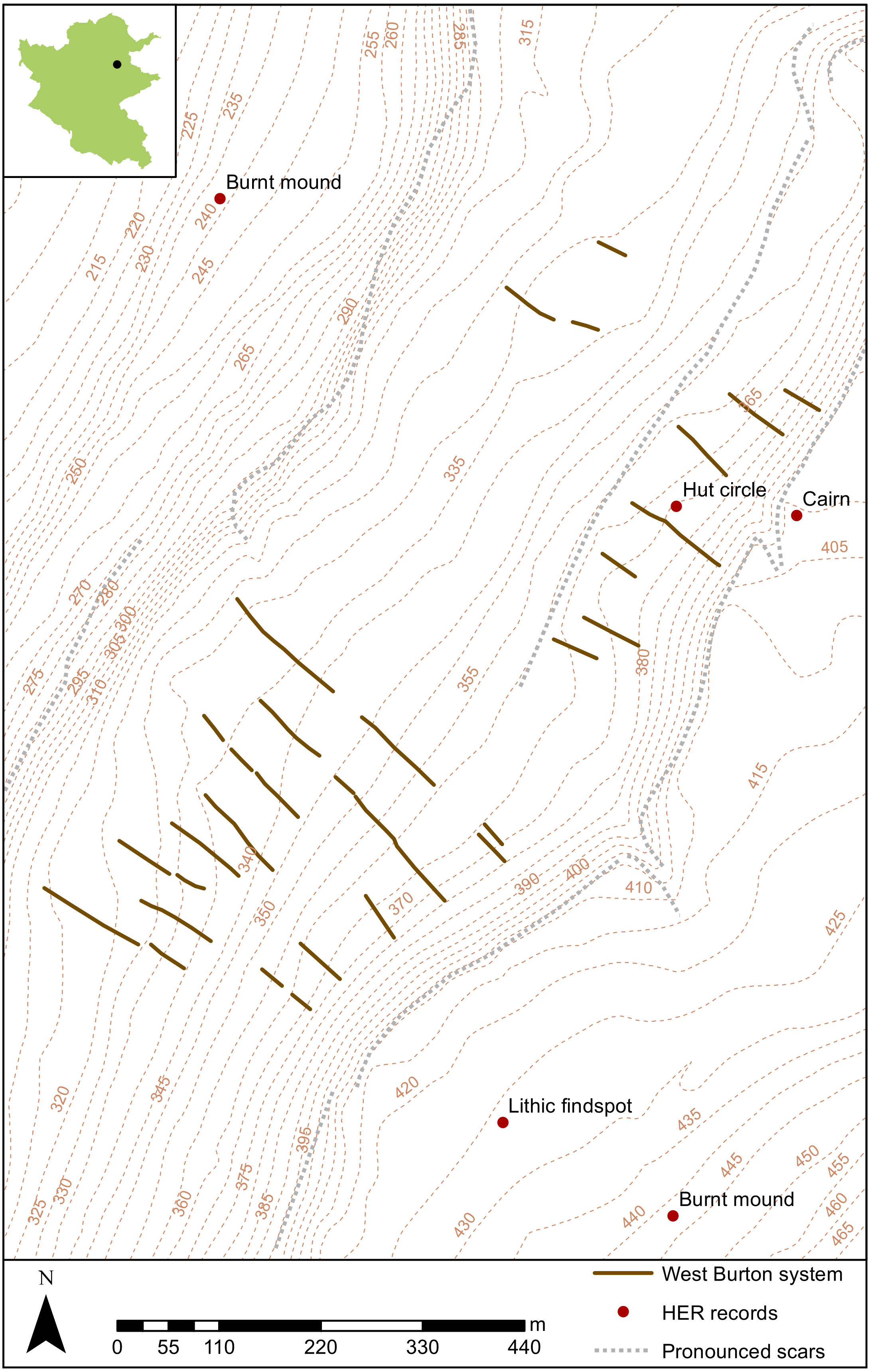


Fig. 4.98 West Burton coaxial system in relation to features/finds known from the HER.

West Burton is a relatively compact coaxial system located on the northwest facing edge of West Witton Moor/ Burton Moor, above the village of West Burton, at the confluence of Bishopdale and Wensleydale. The 31ha system lies on Stonywoods Plain, a broad terrace of the valley side, immediately below Dove Scar and above a steep drop into the valley. Yoredale rocks, with outcrops of other limestones and Yoredale sandstone, form the bedrock in this area.

The remains of at least 31 sections of boundary run northwest from the bottom of Dove Scar towards the edge of the horizontal terrace on which they sit, where the ground falls steeply away into the valley. Along the southern part of the foot of Dove Scar, a line of historic mineral workings overlie the uppermost extremities of the boundaries, which do not appear to continue above the scar line. Dove Scar is bisected by the steep sided gill of Ashby Gill, which may have offered a natural topographic boundary to the system as there appears to be an interruption in the regularity of the axial boundaries. However, the boundaries are also found to the northeast of the gill and are treated as a single system here due to the limited break. At the time of visiting, visibility was limited by long grass. The Bronze Age settlement of Burton Moor lies approximately 800m to the south (Fairless 2004).

4.8 The Swaledale systems

4.8.1 Swaledale

Fig. 4.99 View east from Upper Swaledale, overlooking a tributary of the Swale in the foreground. Photo: author.

Swaledale, in the north of the National Park, runs from west to east, with the River Swale flowing across a flat, narrow valley floor and between steep valley sides. The tributary valley of Arkengarthdale joins the main dale at Reeth. Historically, lead has been mined extensively along the north side of the valley. Above the small enclosed fields of the valley bottom, the upland areas are overwhelmingly maintained as grouse moor: the coaxial systems in this valley are predominantly covered in heather, making it difficult to decipher archaeological remains unless the heather has recently been burnt. Fortunately, these systems have been surveyed over many years as part of the Swaledale Ancient Land Boundaries Project (Laurie *et al*. 2011). The Swaledale systems are some of the largest in the National Park, while further significant examples lie in close proximity on Marrick, Ellerton and Skelton Moors, beyond the park boundary. The HER records the presence of a number of smaller possible prehistoric field systems higher up the dale (see Appendix 2).

4.8.2 Low Row Pasture

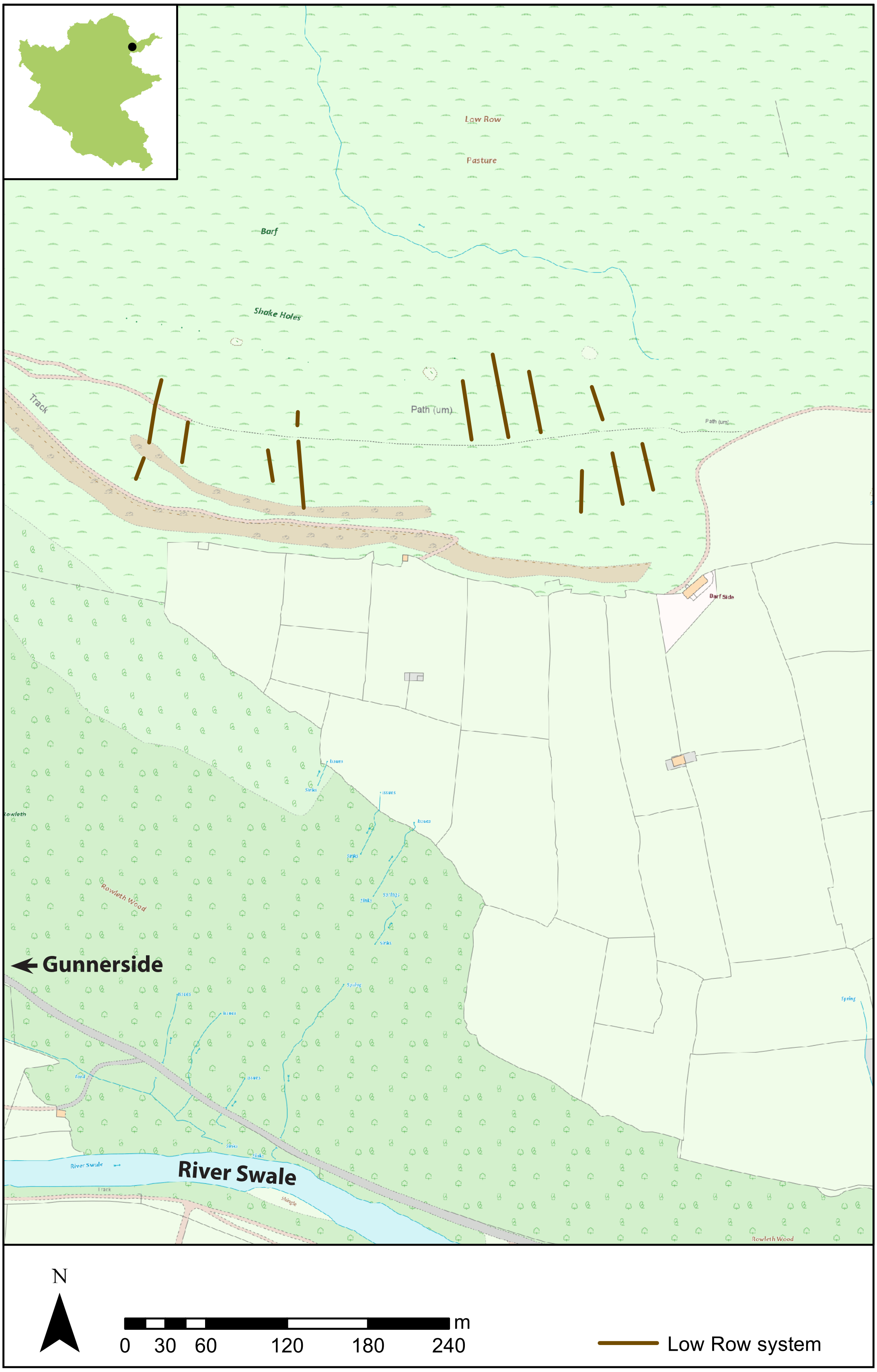


Fig. 4.100 Location of Low Row Pasture coaxial system.

Fig. 4.101 Low Row Pasture coaxial boundaries in geographical context.

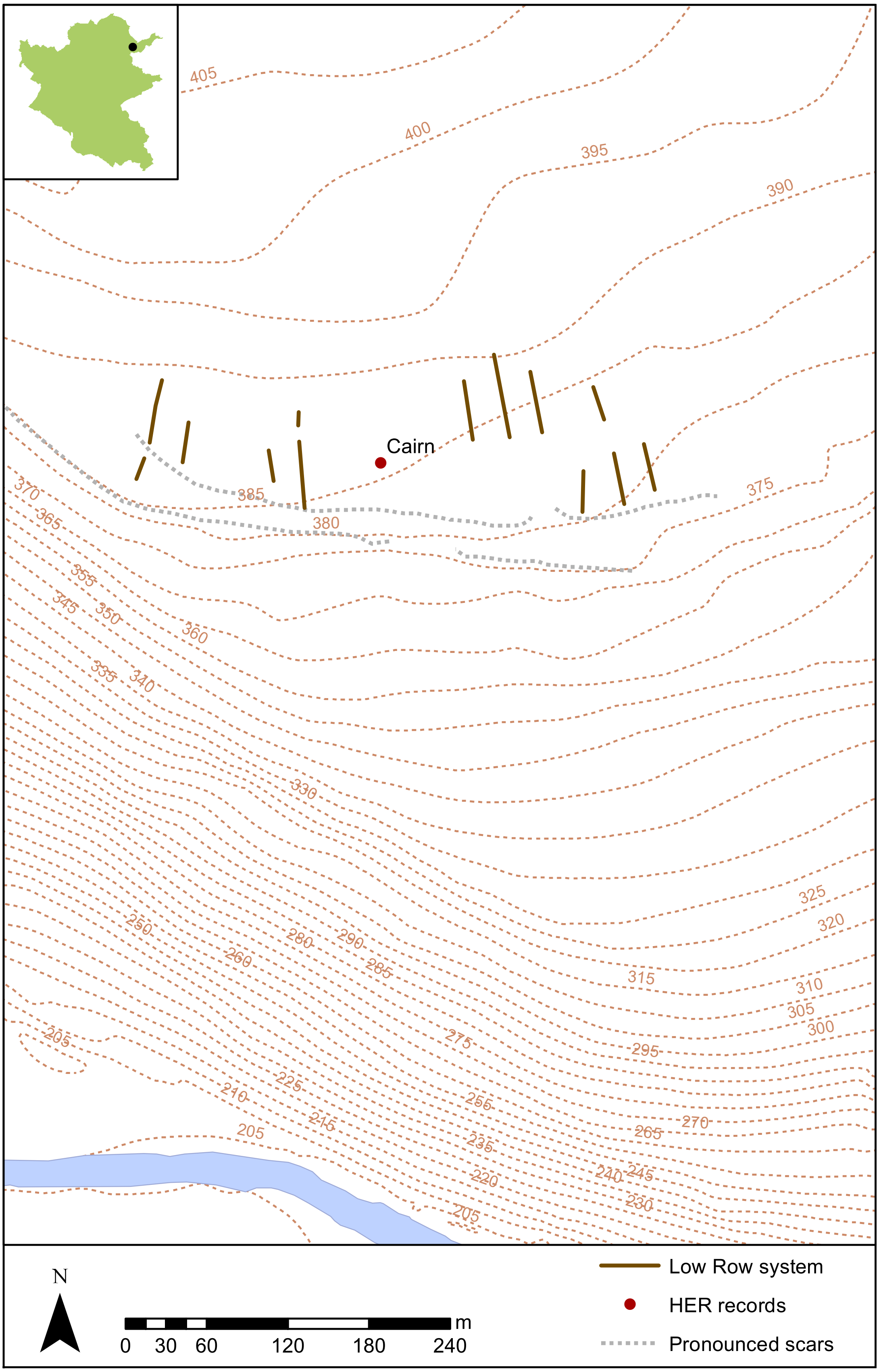


Fig. 4.102 Low Row Pasture coaxial system in relation to features/finds known from the HER.

Fig. 4.103 A turf and moss-covered axial boundary of the Low Row Pasture system. Photo: author.

An outcrop of Middle limestone among Alston limestones, sandstones, siltstones and mudstones forms the bedrock on which this system is situated, overlain by Alston sandstone and peat immediately upslope from the field system. The system is located on Barf Side, on the northern side of Swaledale, approximately 1km west of Riddings and opposite the hamlet of Crackpot. At this point, the valley has a narrow floor and steep sides. Rowleth wood covers the lower slopes, while the available modern pasture is enclosed into small fields, above which is open moor. There is evidence of historic mineral working nearby.

Approximately ten low, turf-covered boundaries are located immediately upslope of the currently-enclosed fields, separated from the modern walls by a small limestone scar. It is noticeable that the lines of the axial boundaries do not line up with those of the modern fields within the intake pasture, and it is possible that the lower extent of the coaxial system was marked by this scar. The coaxial boundaries then run approximately 180m across a flat plateau before they appear to come to an end below another small, grassed over limestone terrace. It is not apparent whether they continue upslope of this due to an extensive area of bog. Covering around 6ha, and amounting to 479m of visible boundaries, this is the smallest system in the Dales; it is not apparent at present whether this represents its original proportion. Laurie *et al.* assert that these coaxials are associated with six house platforms and enclosures located in Rowleth Wood, as well as small cairns, lithic scatters and a burnt mound on Stoops Rigg (upslope) (Laurie *et al*. 2011: 47).

4.8.3. Healaugh

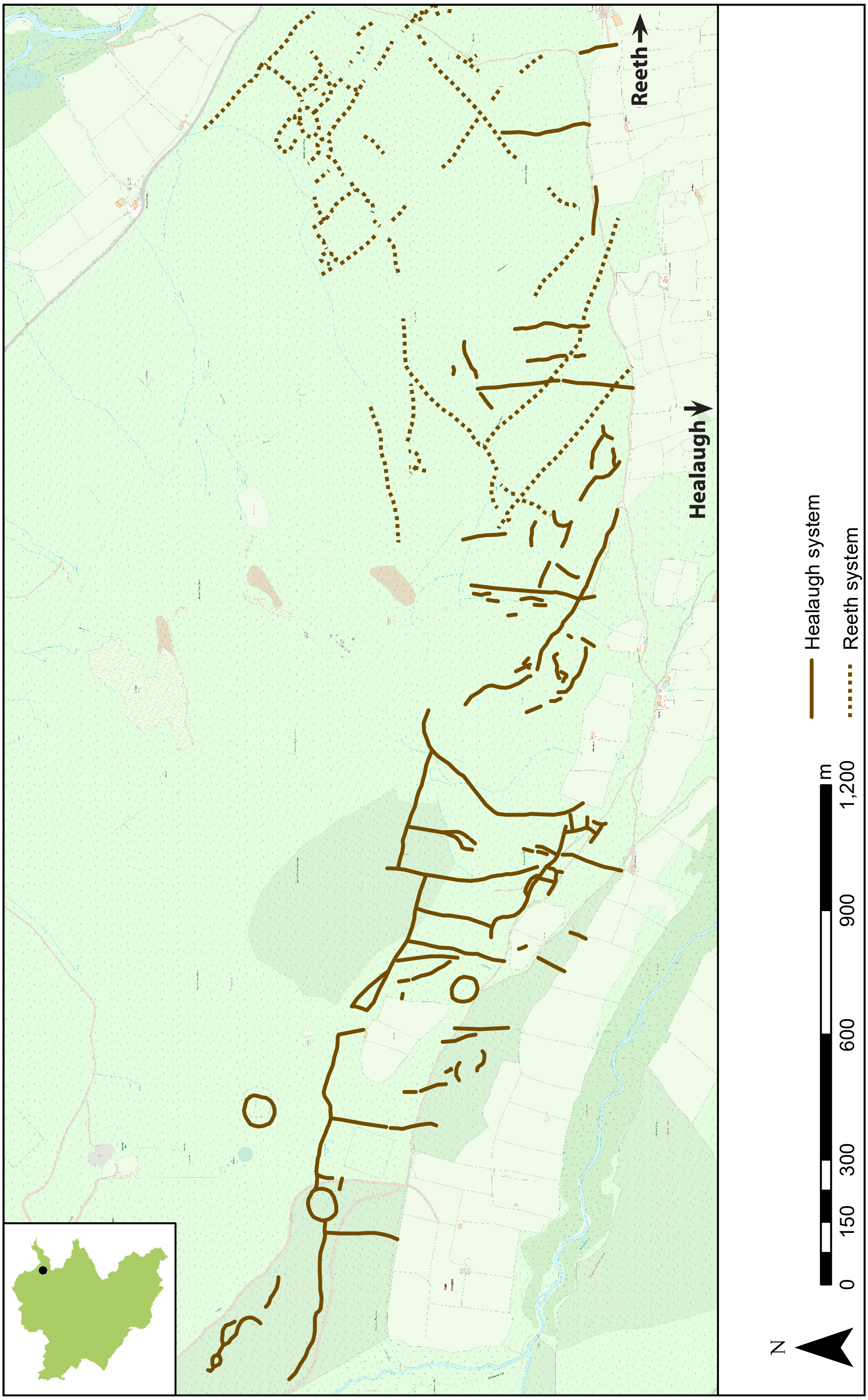


Fig. 4.104 Location of Healaugh coaxial system.
(Map after Laurie et al. 2011: 48)

Fig. 4.105 Healaugh coaxial boundaries in geographical context.

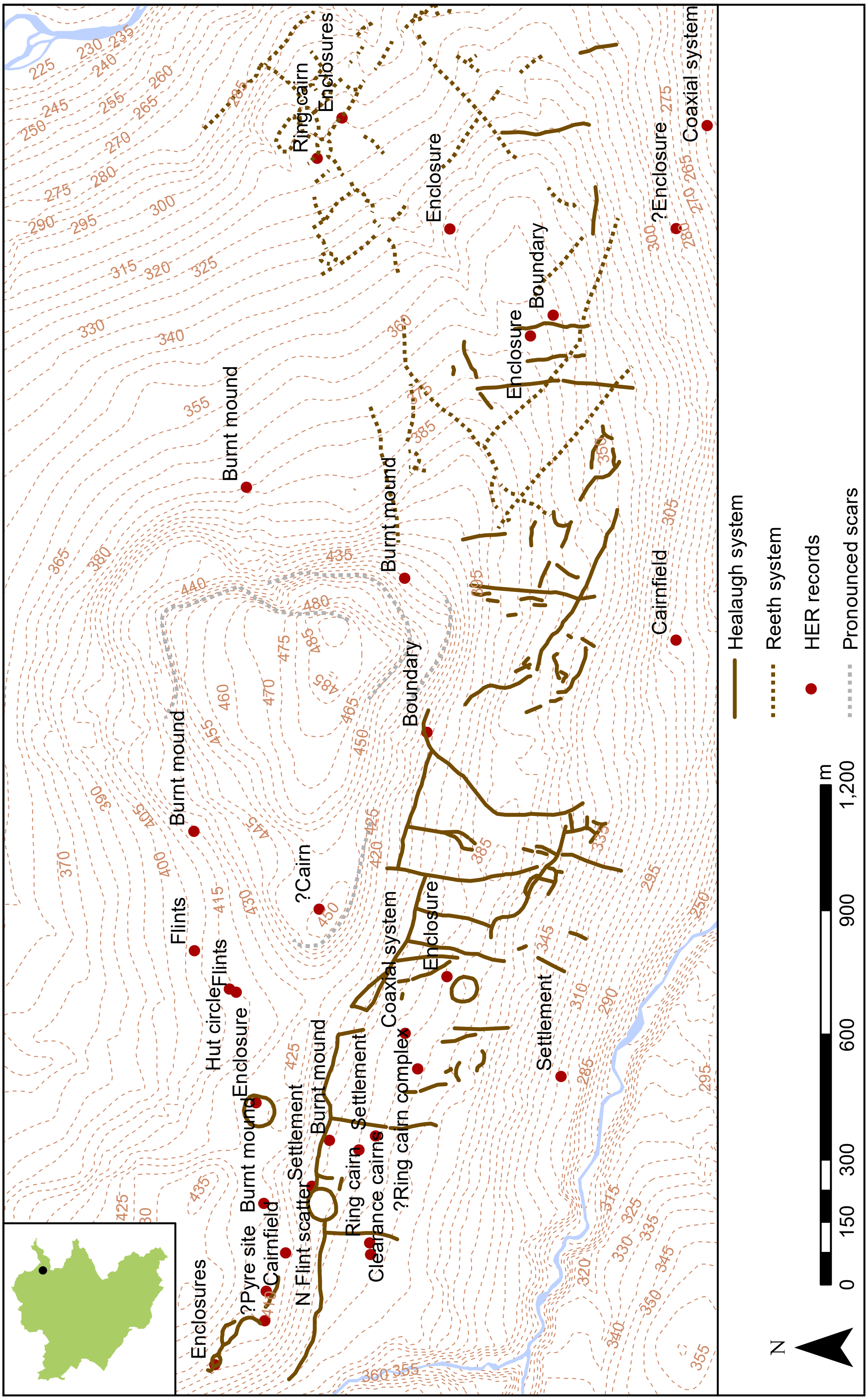


Fig. 4.106 Healaugh coaxial system in relation to features/finds known from the HER.

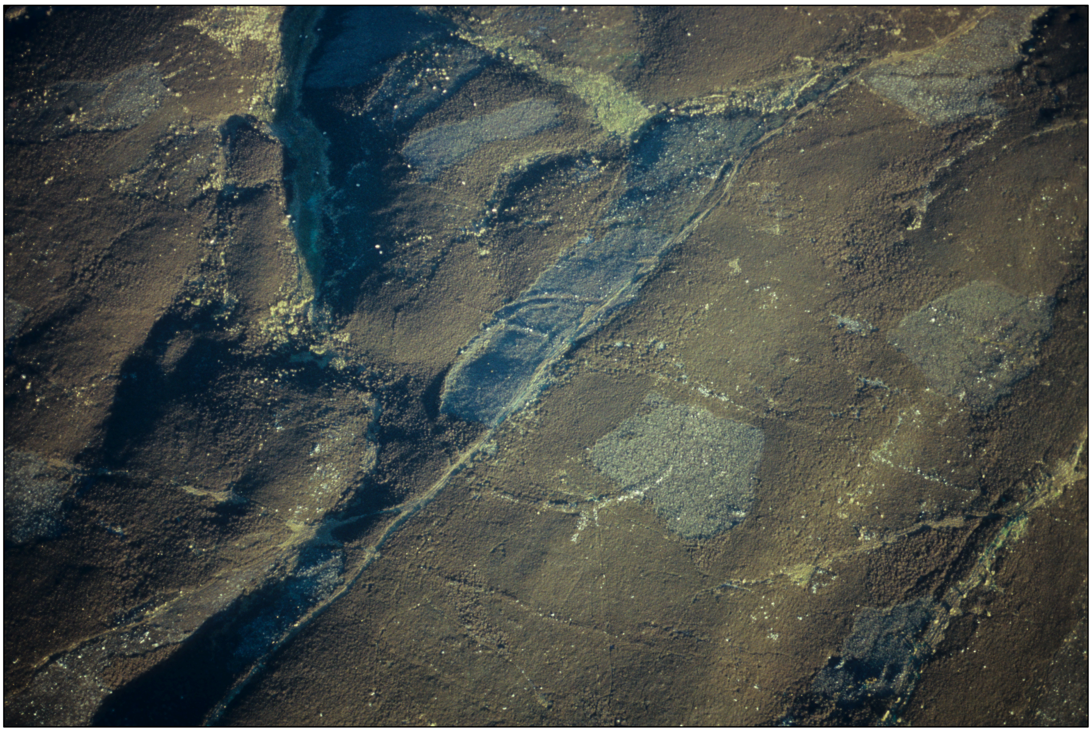


Fig. 4.107 Aerial view of parts of the Healaugh and Reeth coaxial systems, looking northeast. The circular enclosure has a diameter of around 40m and represents Fleming's earliest phase of the Reeth system. This is cut by axials of the Healaugh system, which run diagonally across the frame from upper left to bottom right. Photo: YDNPA YDP031-26.

This system extends across the south- and southwest facing slopes of Cringley Hill and Calver Hill, north and west of the village of Healaugh in mid Swaledale. Extending almost 3km east from Cringley Bottom, the system overlooks Barney Beck, a tributary of the Swale. The bedrock here is predominantly Alston limestone with subordinate sandstone, with outcrops of Middle and Simonstone limestones and Alston sandstone. The land is maintained as heather grouse moor.

Covering over 141ha and containing at least 10 000m of known boundaries, this system is one of the largest in the Dales (probably due in part to such close survey). The most prominent feature of the system is that which appears to act as an upper terminal, defining the western half of the system and occurring in steps along the *c.*390-410m contours. The presence of another, roughly parallel, transverse boundary lower down the slope may suggest an expansion of the system at some point. The upper terminal boundary abuts and respects a circular enclosure containing a number of small cairns and two building platforms (Laurie *et al*. 2011: 48). A second circular (settlement) enclosure is located approximately 150m upslope of the terminal. The survival of the system has been affected by phases of moorland intake, the results of which are visible in fig. 4.105. This has contributed to fragmentation of the axial boundaries in particular, some of which are also relatively sinuous in form. Axials in the eastern portion of the system are less frequently spaced (and/or less well preserved) than those in the west. Numerous small cairns and lithic scatters have been recorded in the western half of the system, with comparatively few in the east (Laurie *et al*. 2011: 48-50). The eastern part of the Healaugh system overlies part of the Reeth system, providing what Fleming refers to as 'Phase III' (Fleming 2010: 142 and fig. 9.3).

4.8.4 Reeth

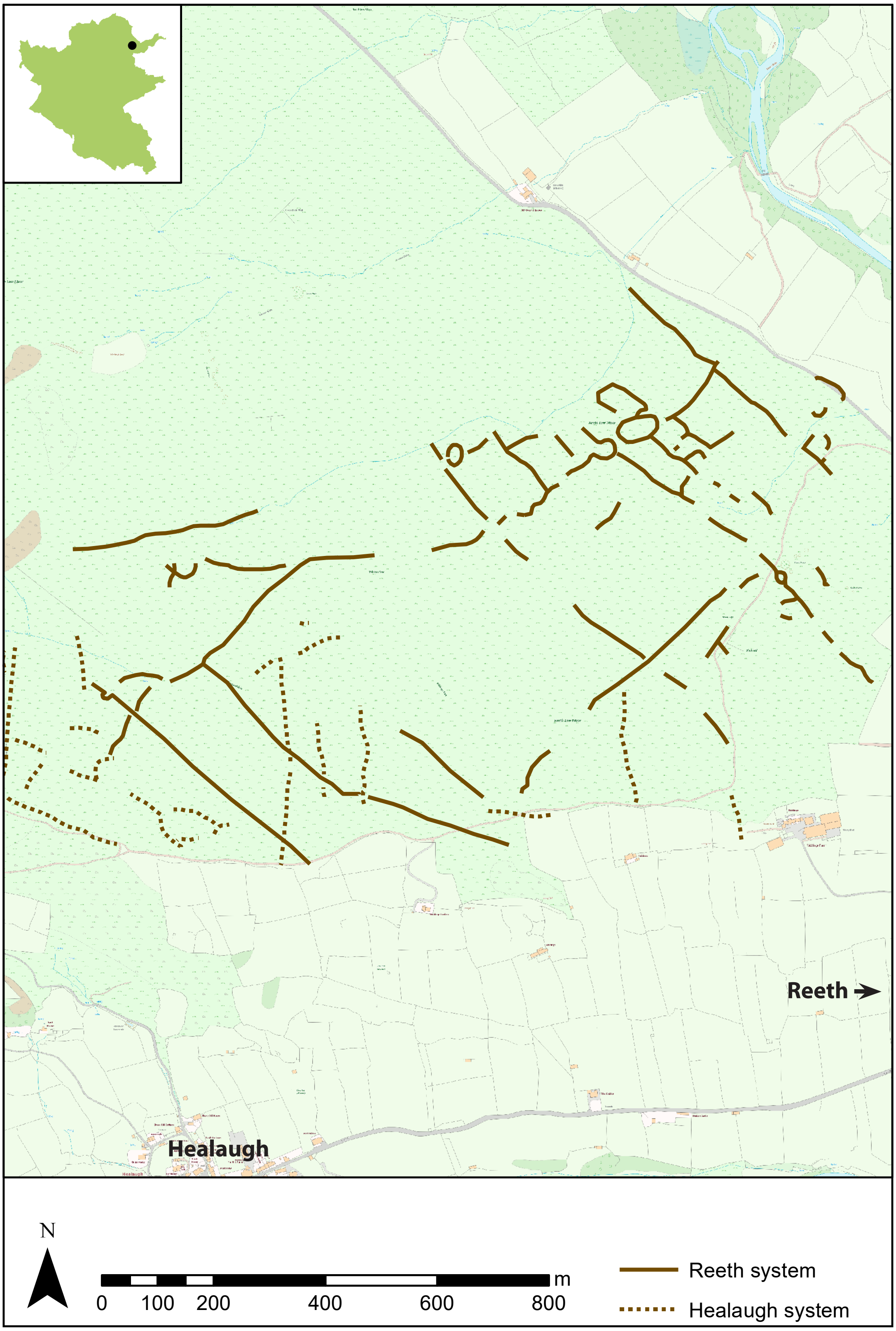


Fig. 4.108 Location of Reeth coaxial system.
(Map after Laurie et al. 2011: 48)

Fig. 4.109 Reeth coaxial boundaries in geographical context.

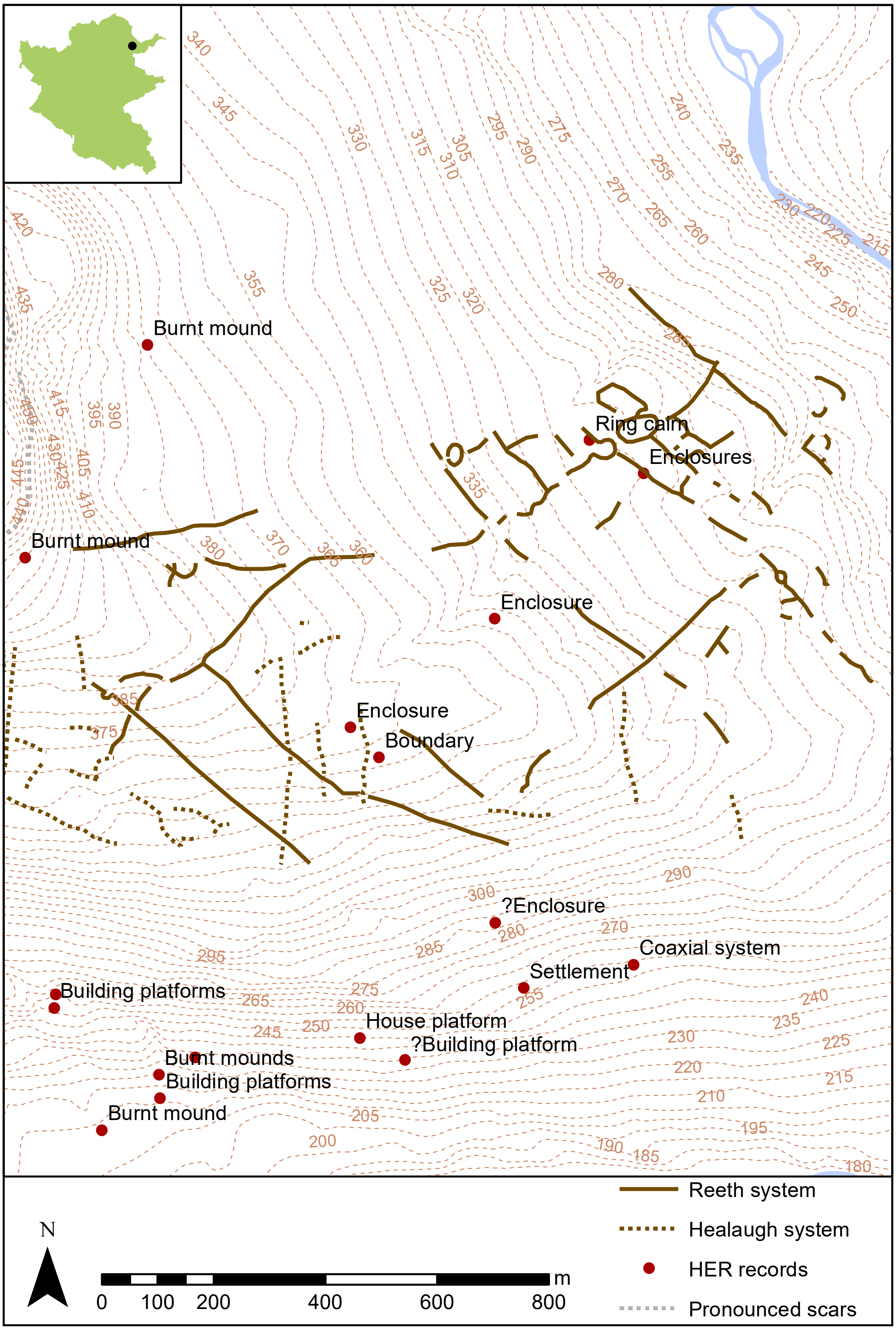


Fig. 4.110 Reeth coaxial system in relation to features/finds known from the HER.

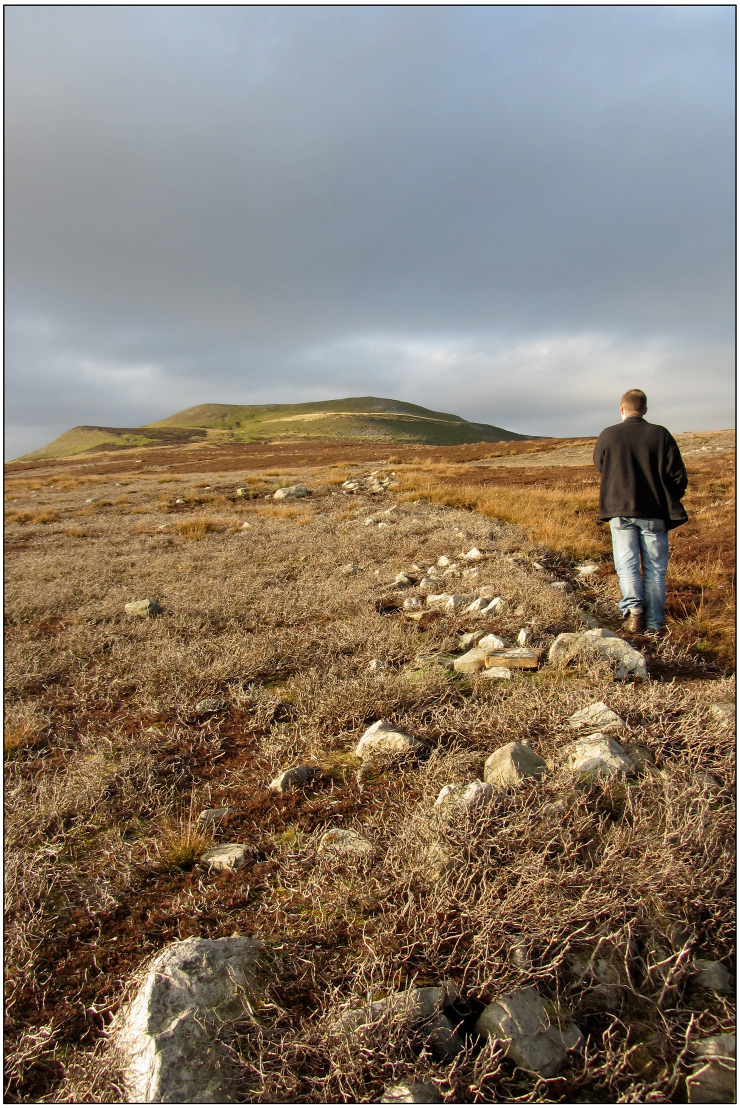


Fig. 4.111 Axial boundary of the Reeth system, looking towards Calver Hill. Photo: author.

This system is located on Riddings Rigg, the south- and southeast facing eastern shoulder of Calver Hill in Mid Swaledale. Covering an area to the north and east of the village of Healaugh, the system overlooks the main valley of Swaledale, just above its confluence with Arkengarthdale. The bedrock here is predominantly Alston limestone with subordinate sandstone, with outcrops of Middle limestone and Alston sandstone. The land is now maintained as heather grouse moor.

Several phases of field system cover the southern flank of Calver and Cringley Hills, as described above: this one forms Fleming's Phase II of land use here (Fleming 2010: 142 and fig. 9.3). The system is aligned northwest-southeast and lies generally across the contour, although this is not always strictly the case due to the topography of the spur of land upon which it sits. It covers around 102ha. These boundaries overlie an earlier phase of activity that includes two large circular enclosures and a sinuous boundary (see fig. 4.106). A possible upper terminal is visible, although axial boundaries and enclosures above it at the eastern end of the system imply more than one phase of use if it is indeed a terminal. Similarly, an apparent lower transverse boundary may suggest a further phase of expansion. A number of shorter transverse boundaries and enclosures are located around the northeastern extent of the system, in contrast to the centre, where relatively little distinct evidence is apparent. The Reeth system in general contains relatively few settlements, subdivisions and cairns compared with the neighbouring Healaugh system (Laurie *et al.* 2011: 48).

4.8.5 Harkerside

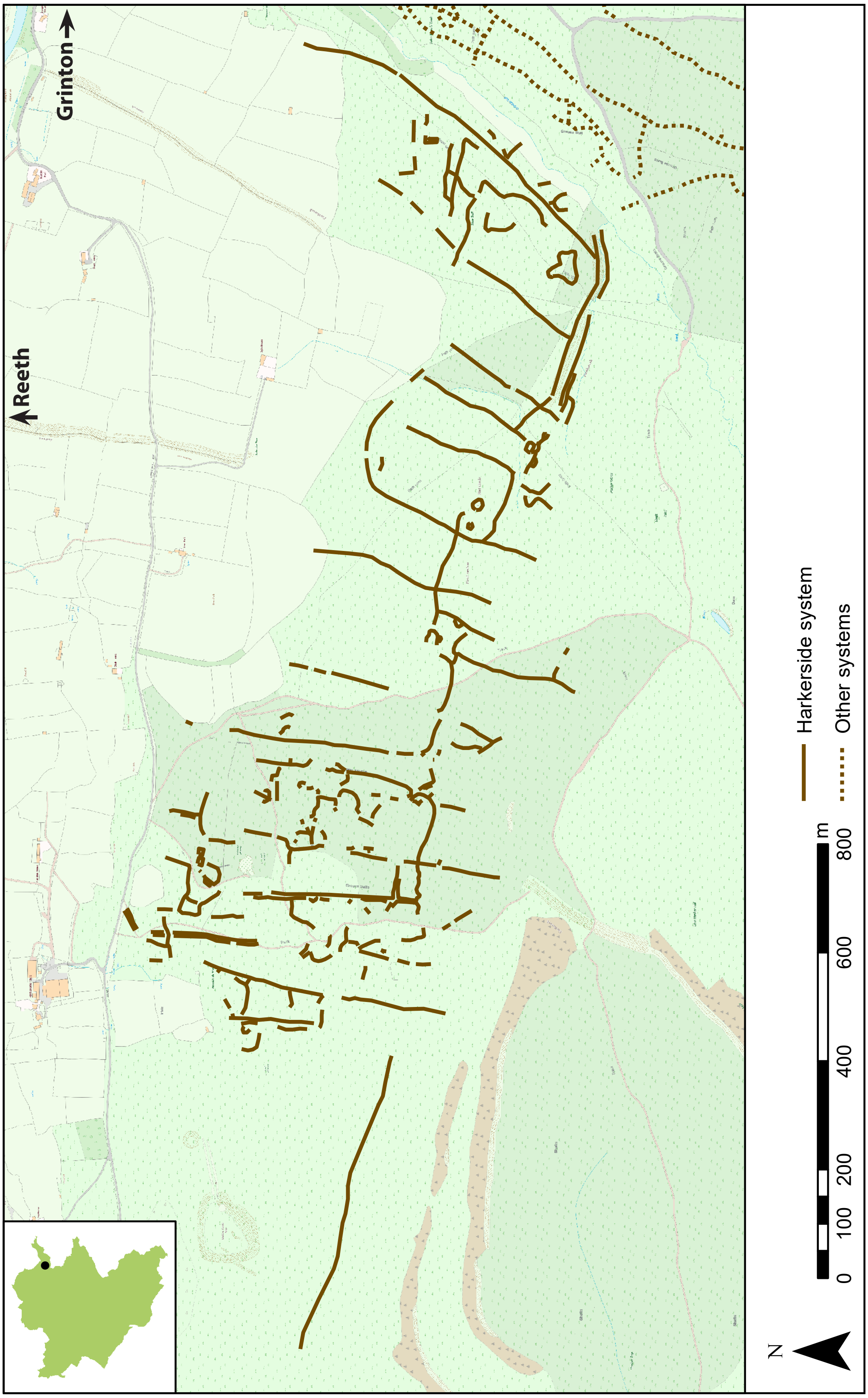


Fig. 4.112 Location of Harkerside coaxial system. (Map after Laurie et al. 2011: 43)

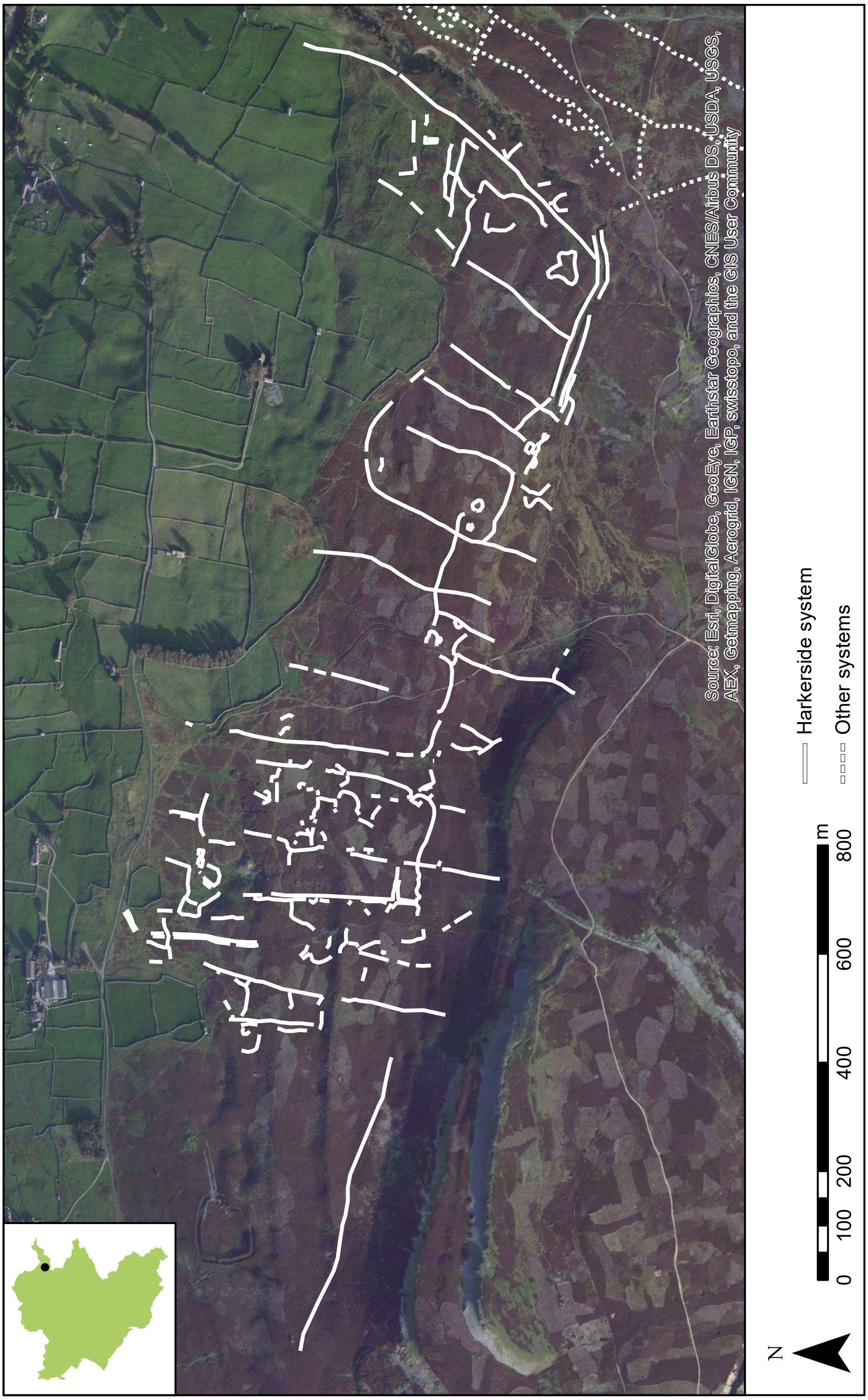


Fig. 4.113 Harkerside coaxial boundaries in geographical context.

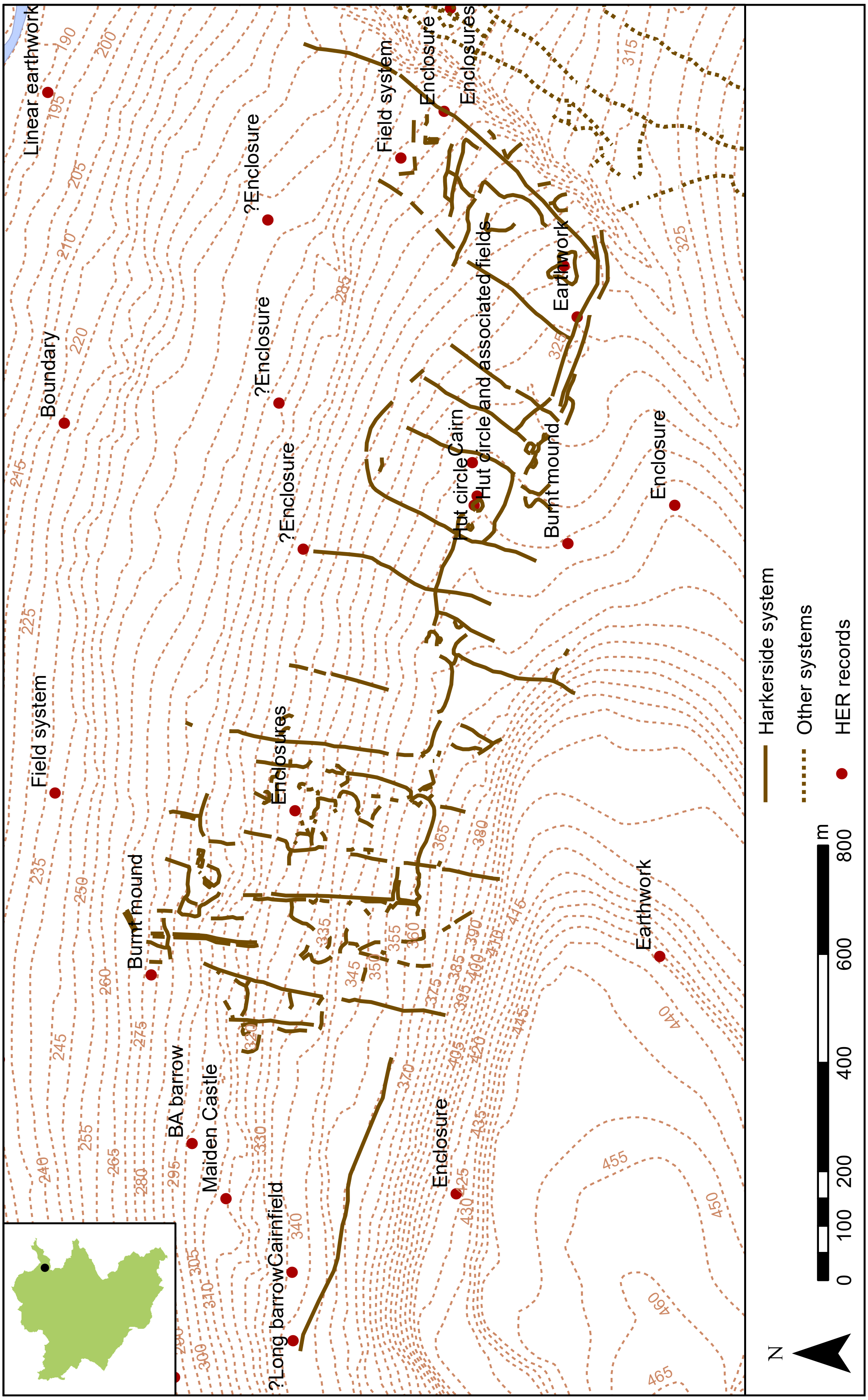


Fig. 4.114 Harkerside coaxial system in relation to features/finds known from the HER.

Fig. 4.115 One of a group of several probable clearance cairns located within the Harkerside coaxial system. Fremington Edge can be seen in the distance (right of frame), marking the edge of the National Park and, along the far side of its 'edge', Marrick Moor coaxial system (lying outside the Park). Swaledale. Photo: author.

This system is located on the southern side of Mid Swaledale, overlooking the village of Reeth, which stands at the confluence of the Swale and Arkle Beck. The boundaries extend across Harkerside, from Maiden Castle in the west to Cogden Gill in the east, making it one of the larger systems in the National Park (though one of the smaller systems in Swaledale). This area is maintained as heather moorland; the underlying geology in this area is Alston and other limestones with subordinate sandstone. This is another system with an upper terminal: running the full width of the system, it incorporates (or is incorporated by) the linear earthwork that is part of the so-called 'Grinton-Fremington dyke system' to the east, and extends approximately 500m to the west of the most westerly axial boundaries. This is not a continuous feature, but is composed of segments located at slightly different altitudes. Moreover, a number of axial boundaries appear to run upslope from this terminal, perhaps suggesting a further phase of use. Downslope, the system runs into the extant medieval and post-medieval field systems, although it is worth noting that they run on the same alignment as the ‘Grinton-Fremington dykes’ (large earthworks that run across the valley), which have recently been re-dated to the late Bronze or early Iron Age (Ainsworth *et al*. 2015). In addition to coaxial boundaries, small clearance cairns, isolated large cairns, burnt mounds, droveways and lithic scatters have been recorded within the area of the system. In particular, Laurie notes settlements close to Grinton Gill and cairnfields within the western and central portions of the coaxial system (Laurie *et al*. 2011: 45-46). The western area of the system also demonstrates the presence of at least three droveways, aligned alongside axial boundaries (Fleming 2010: 144-5).

4.8.6 Grinton Moor

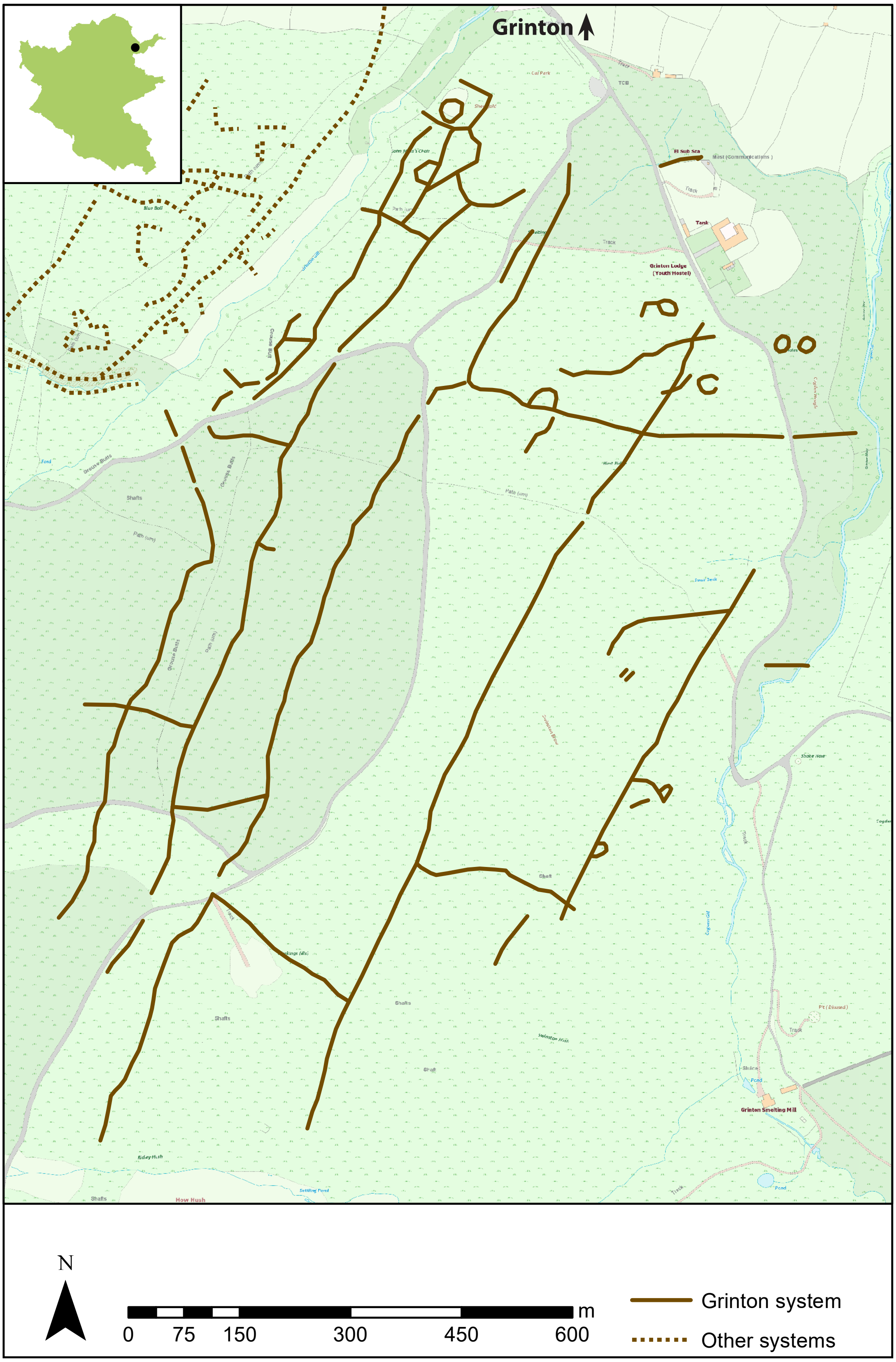


Fig. 4.116 Location of Grinton Moor coaxial system. (Map after Laurie et al. 2011: 41)

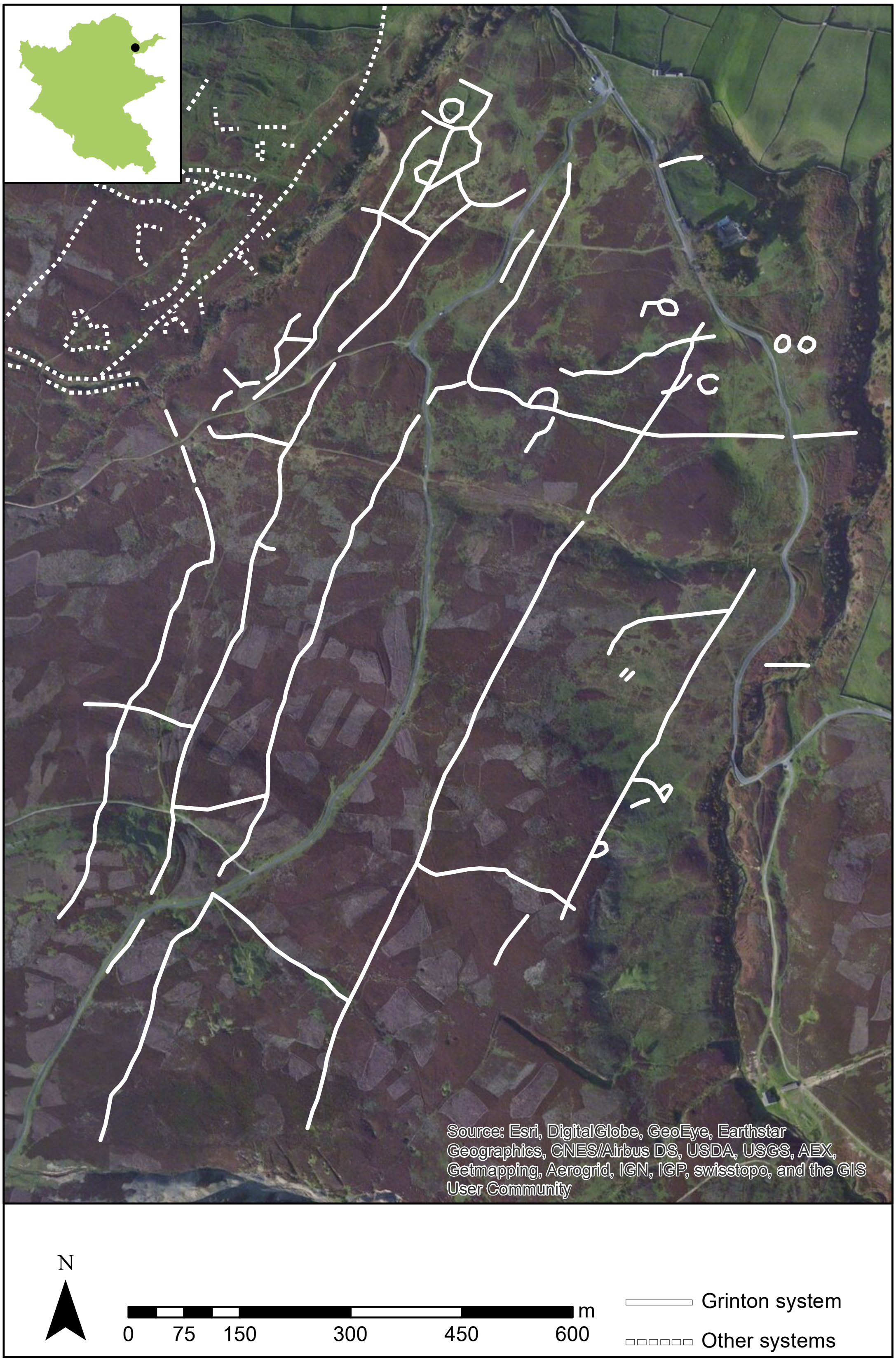


Fig. 4.117 Grinton Moor coaxial boundaries in geographical context.

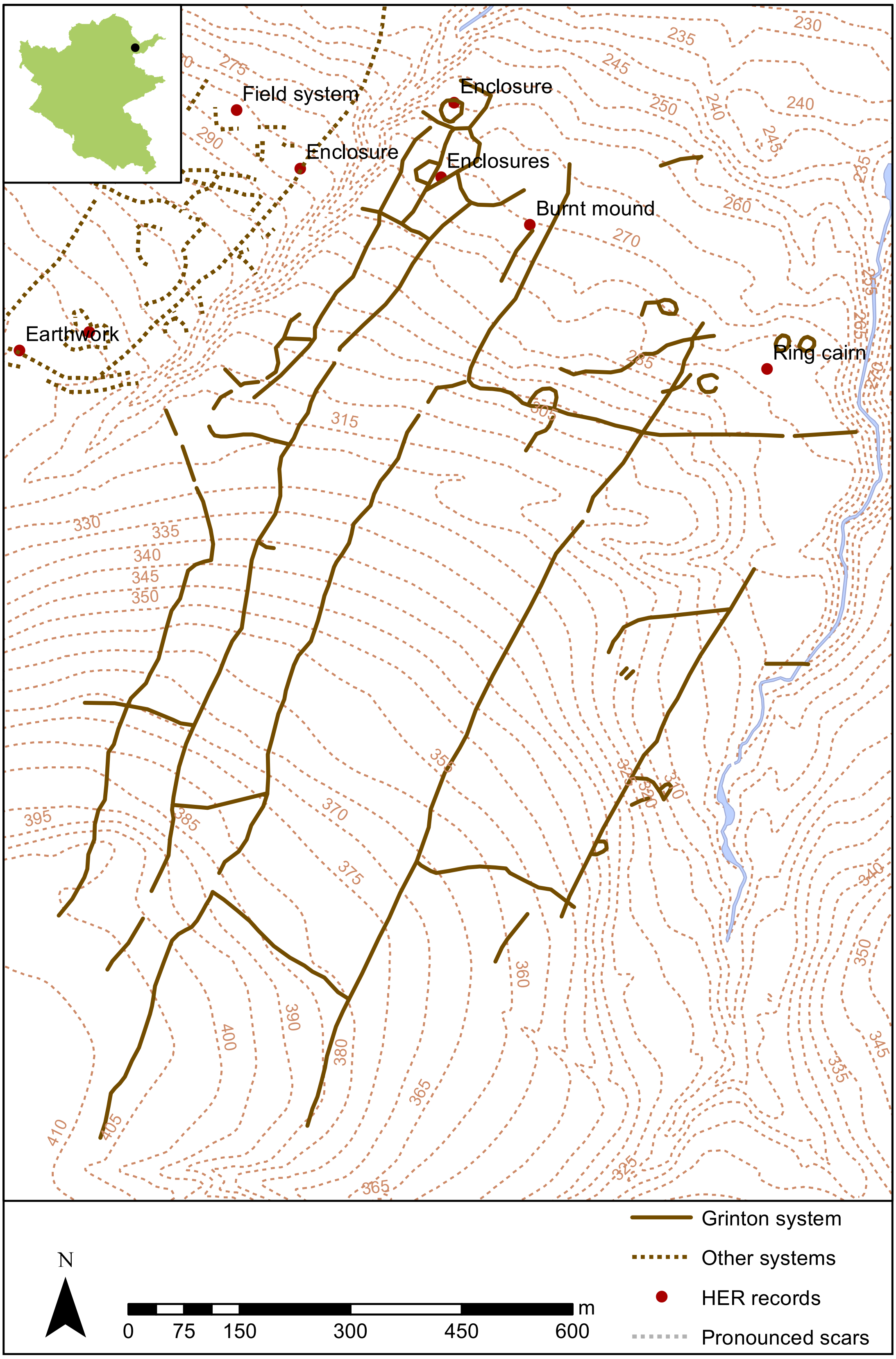


Fig. 4.118 Grinton Moor coaxial system in relation to features/finds known from the HER.

Fig. 4.119 View of a heather-covered axial boundary (indicated) of the Grinton Moor coaxial system, looking north towards the main dale of Swaledale. Photo: author.

The Grinton Moor system is located on the heather-covered southern side of Swaledale, directly east of, and sharing a north-northeast-south-southwest axis with, the Harkerside system. Situated on Alston and other limestones, with subordinate sandstones, this system covers around 104 ha and is treated as a separate system to Harkerside on the grounds of its natural topographic enclosure (between Grinton and Cogden Gills to the west and east respectively) and the subtly different layout of its boundaries, which here form larger coaxial strips. Downslope, the main axial boundaries are lost among the extant fields around 265m aOD. Upslope, they end around Ridley Hush at 410m aOD. Unlike the Harkerside system there is no evidence for terminal boundaries at either end, although a number of transverse boundaries cut across individual coaxial strips. Fewer cairns have been identified within this system than other Swaledale systems, with those that are known tending to appear in the lower portions of the system (Laurie *et al*. 2011: fig. 6.3). Also in the lower part of the system, a settlement consisting of four large roundhouse enclosures has been identified, with enclosures and possible settlement remains dotted across the system (Laurie *et al*. 2011: 41). Field survey has identified the boundaries of the northeastern portion of the system as belonging to an early phase (Laurie *et al*. 2011: 41).

5. Coaxial systems of the Yorkshire Dales: analysis

Whether the boundaries themselves or the internal content of the ‘fields’ were of foremost consequence is not apparent at this stage. Presumably both elements worked together, alongside other components and resources, to form the system as a whole. In some respects the coaxial strips and their boundaries can be thought of here as analogous to the polylines and polygons that represent them in the GIS. Both have the characteristics that must be selected when drawing in any vector graphics programme: boundaries have width, direction, form and frequency; the spaces (or places) between them have dimensions of area, orientation, fill/colour and shape. Both have a spatial relationship to other features of the same category and to other categories. It is difficult not to see them as the layer (or layers) of polylines and polygons draped over the three dimensional elevation ‘model’ that is the hillside. This chapter examines these layers, looking for patterns and applying simple analyses in order to characterise the elements of the coaxial systems identified and outlined previously.

5.1 Size and shape: the boundaries and the bounded

5.1.1 The nature of the boundaries

The late prehistoric coaxial boundaries of the Yorkshire Dales are overwhelmingly composed of stone rubble/turf and small-medium size boulders of the local limestone and, in the northern dales, sandstone - of which a plentiful supply exists. If they originally had an adjacent ditch, this is no longer visible from the surface, and indeed seems unlikely, given the thin soil structure of the limestone areas. As noted above (see Section 4.1), a small excavation of a boundary in the Healaugh system revealed facing stones with rubble fill (Fleming 2010: 140, fig. 9.1) (fig. 5.1), indicating some degree of care was taken, at least in some places or at some times, that lifts these constructions beyond slapdash clearance heaps, although this is not to say that others were not built up from clearance stones piled against fences.

Fig. 5.1 Excavated boundary near Healaugh, Swaledale, demonstrating facing stones and rubble core. (Reproduced from Fleming 2010: 140, fig. 9.1.)

Excavation of a 20m wide corridor in advance of a pipeline being laid at Appletreewick, mid Wharfedale, noted a series of boundaries of a possible coaxial system (see Appendix 2): two were composed of regularly laid boulders filled with a core of smaller stones. On the other hand, four more were described as spreads of undifferentiated stone rubble 0.9 - 2m wide and 0.3 - 0.45m high (Cardwell *et al*. 1990: 5). Although no primary records of his invasive investigations near Grassington are known to exist, Raistrick commented that:

> Trial trenches have been made across the balks in several places and reveal the same structure everywhere, a small core of loam or turf and large stones, usually set directly on the subsoil, and a covering of turves and smaller stone rubble. There is no trace so far of anything resembling coursed masonry (Raistrick 1937: 168).

Variability in construction could arguably point to the linearity of these features being the important element, with less sophisticated, less involved attempts to copy the ‘proper’ lines also considered sufficient. The range of construction models might reflect the irrelevancy of form, which was left to the interpretation of the individuals creating the boundaries and the circumstances of time and labour available. It may also be a reflection of a long lifespan of the systems and the metamorphosing of priorities, practicalities and approaches throughout this time.

It is generally assumed that field boundaries of this type would have originally been topped with a fence or hedge in order to render them stock proof (Fleming 2008: 94, fig. 53; Pryor 2006). Hedges could have been managed to provide the added advantages of harvests of wild food, fuel and coppiced timber, as well as additional shelter as many boundaries are orientated at right angles to the wind as it is funnelled down the valleys. The structure of the faced walls must have added to the sense of ‘permanence’ already generated by the building of boundaries out of stone, with a hedge also helping to embed the construction into the landscape. These boundaries are reminiscent of traditions that survive regionally until the present day, for example in the hedge banks of the southwest of England. Fig. 5.2 gives an impression of the effectiveness of these structures for keeping stock under control. The following figure shows a modern dry stone wall in a state of partial collapse, demonstrating the similarities between it and many of the prehistoric boundaries - although, judging by the remains, even allowing for later robbing for wall building, it cannot be suggested that the prehistoric coaxial boundaries were so imposing in terms of the quantity of stone involved.

Fig. 5.2 Traditional boundaries comprising walling topped with hedgerows, Dartmoor National Park. Photos: author.

Fig. 5.3 Dry stone walling in a state of disrepair, Wharfedale. Photo: author.

In many parts of the modern world, as surely in the past, grazing animals are supervised, often by the employment of children (fig. 5.4). In such circumstances, with intensive shepherding of a small number of animals, few fences are necessary, let alone sturdy, stock proof barriers. The presence of such substantial boundaries as those of the coaxial systems therefore implies pastoral agriculture on a larger scale was taking place, or alternatively (or, additionally) that the boundaries had a symbolic role in, for instance, land division. In giving a sense of the scale of the undertaking, Caulfield has pointed out that the construction of the great mound at Newgrange is regarded as a feat of organization, yet the walling of a single coaxial Neolithic field at Céide - which bear great morphological resemblance to later prehistoric examples - contains no less building material (Fleming 1987: 195). Presumably a simple cordon fence was inadequate.

Fig. 5.4 In the Anosy region of southeast Madagascar, cattle are not kept in fields per se but are herded in small groups by children. Typically, individuals own one animal and pay to have it looked after communally. Photo: author.

5.1.2 Additional (in)visible boundaries

The maps of the previous chapter indicate the surviving axial boundaries; it is not inconceivable, however, that this land was further divided up, perhaps with great complexity, through the use of more ephemeral and less archaeologically visible methods than stone banks, some of which may indeed have been invisible at the time of use. Hedges, fences and stakes would leave little archaeological evidence, while some 'markers' and natural features could leave none at all - this situation reaffirms the difficulties of a study based on above-ground evidence. Pryor notes that in his experience hedges are rarely found without an associated earthwork marker, however small (Pryor 2006: 84), and while features of this type may be recognisable in the large, stripped areas of the fenlands, they could be extremely difficult to identify amongst the rough vegetation, scree and limestone pavement of the Dales. Figs. 5.5-5.6 demonstrate the modern division of larger areas using few substantial boundaries. When asked about local farming traditions in the Anosy region of southeast Madagascar, a village elder explained that:

The plant called ambatry [is traditionally used] as a boundary - it is known that everyone uses that. Now some people use acacia or sisal instead. They use this because ambatry is good for laoky [a traditional side dish] too. Here most people use acacia or sisal. (Sosony, pers. comm.)

Fig. 5.6 Land division in southeast Madagascar. An insubstantial fence resting on the ground surface, used to keep zebu cattle off paddy fields. Photo: S. Brown.

Fig. 5.5 Land division in southeast Madagascar. Above: large cassava field divided by a line of young sisal plants (marked). Photo: S. Brown. Below: cassava field differentiated from the surrounding scrub by the extent of clearance and a palm tree. Photo: author.

Demonstrably too large, as coaxial strips of several tens of metres wide and sometimes more than a kilometre in length, for cultivation plots, further land division would arguably also be likely within a pastoral, or mixed, system.

Periodic rotation of grazing areas, for example, helps to prevent overgrazing of favoured areas, protects the ground from damage by poaching, and assists with the regulation of parasites and disease. Specific stock management activities that require a greater degree of control over animals, including lambing and sorting, are also facilitated by the use of smaller pens, as is the provision of shelter. While the coaxial strips themselves may have facilitated grazing rotation, this assumes contemporaneity of the whole system. The possibility of the practice of mixed farming is emphasized at this point, with its reciprocal benefits for both the arable and pastoral elements: for instance, stock are able to graze the remains of the crop after harvest, while also providing manure to improve the soil.

While the nature of ephemeral boundaries is such that they are no longer discernable without more extensive sub-surface exploration, the opposite is true of the potential boundaries formed by natural topographic features, the permanency of which determines that they remain ‘hidden in plain sight’. After all, the landscape, which is given to great localized topographic variation in much of the Dales, remains made up of many of the same water courses, scars, gradient fluctuations and boulders that comprised the late prehistoric environment.

Some of the systems contain little obvious evidence to explain their size and appear to peter out at their extremities. Others are contained by topographical features, primarily sharp changes in gradient, that define and constrain their lateral extent. The Grinton Moor system (Swaledale), for example, fits neatly between the steep gullies of Grinton Gill, containing Grinton Beck, to the west and Cogden Gill/Cogden Beck to the east, which are incised into Grinton Moor. Although further boundaries are to be found to the west of Grinton Gill, this further system has a different character and is summarized here as Harkerside system (after Laurie *et al*. 2011). Two of the southernmost boundaries of the Grinton system terminate at another watercourse (now Ridley Hush). Fig. 5.7, a plot of gradient, highlights these features.

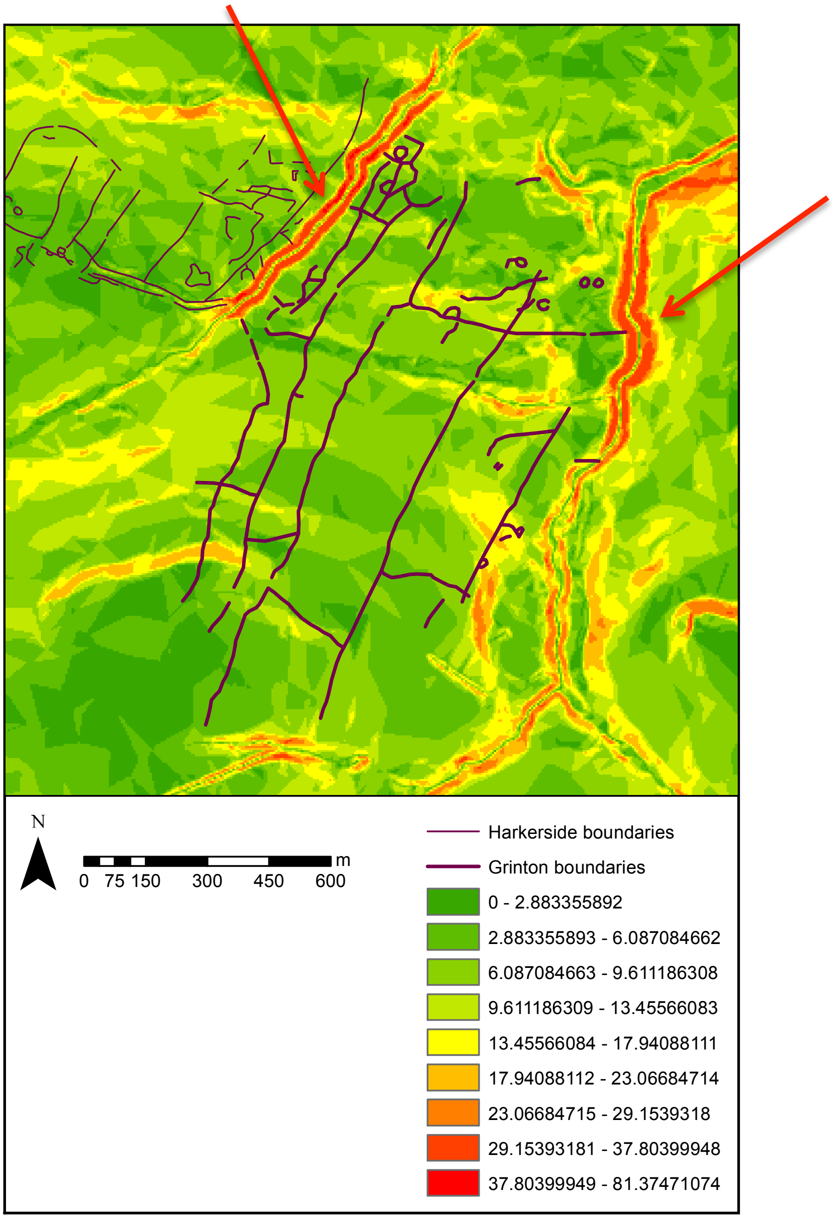


Fig. 5.7 Gradient plot highlighting the situation of the Grinton Moor coaxial system between the steep-sided gills of Grinton and Cogden Becks (marked). These watercourses flow into the River Swale to the north. The gradient (as a percentage) is plotted with the steepest areas as red and the least steep as green. (Derived from OS Terrain-5 contour data.)

The coaxial system at West Burton (Wensleydale) is confined by limestone scar lines to the southeast (upslope) and northwest (downslope) and is located on the plateau between these steeper zones (figs. 5.8 - 5.10). There is no evidence for the continuation of the axial boundaries beyond the upper or lower scars.

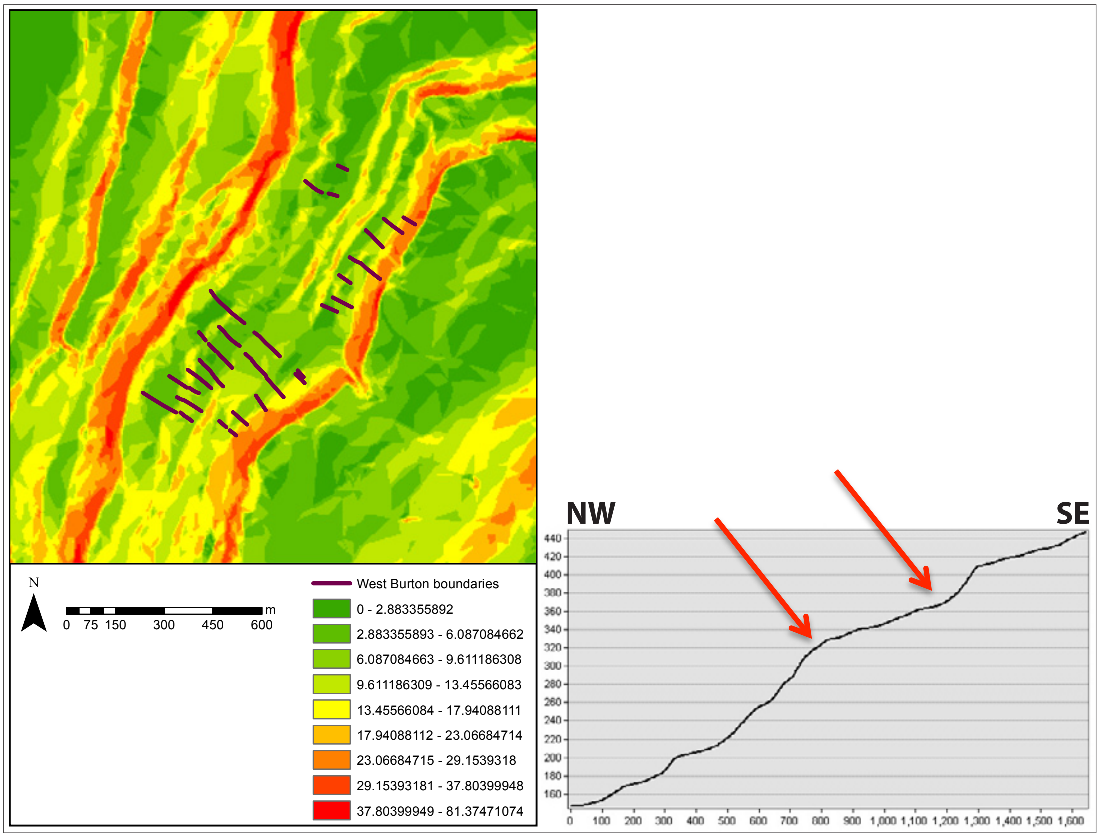


Fig. 5.8 Left: gradient plot highlighting the location of West Burton coaxial system boundaries between the upper (southeastern) Dove Scar and the lower (northwestern) scar of the valley side. The gradient (percentage) plot shows the steepest areas as red and the least steep as green. Right: contour profile through the system, upper and lower extents marked by arrows. (Derived from OS Terrain-5 contour data.)

Fig. 5.9 View north towards Wensleydale, looking across the plateau of which the coaxial system takes advantage. The tree tops (centre frame) indicate where the land falls steeply away into the mouth of Bishopdale and the village of West Burton.

Fig. 5.10 View southeast towards Dove Scar, which forms the upper extent of the West Burton coaxial system. Axial boundaries are marked. Below the scar line a prominent line of mineral workings is visible.

Many of the systems are located directly above the steepest part of the U-shaped valley side (which often takes the form of a near-vertical scar and is most obvious in Wharfedale and Littondale), which serves as a cut-off point, intentional or otherwise, for their lower reaches. The Cowside Beck system in Littondale offers one of the clearest examples of this situation (fig. 5.11). Remnant axial boundaries are visible below the high moorland and above the later field systems of the lower valley sides; this arrangement emphasizes the subdivision by these land divisions of one of three major environmental zones and potential zones of associated economic activity. It is possible that the intensive medieval use of the valley floor has truncated the older systems, or indeed, that the later use continued and developed coaxial systems that extended onto the valley floor (note that a more recent stone wall was found on excavation to follow an Iron Age/Romano-British coaxial boundary of the High Park system just to the west of the National Park (Jecock 1998: 27)). The scars of the lower slopes are, however, particularly steep in the limestone dales - in some places insurmountable. Given the systems' observation of topographic features elsewhere as well as these practical disruptions, it would seem likely that the valley floors were managed separately, although the lack of a corresponding obstacle in mid-Swaledale could suggest that the coaxial strips ran down to the Swale. If an artificial lower boundary existed here, it is now lost among the improved pasture.

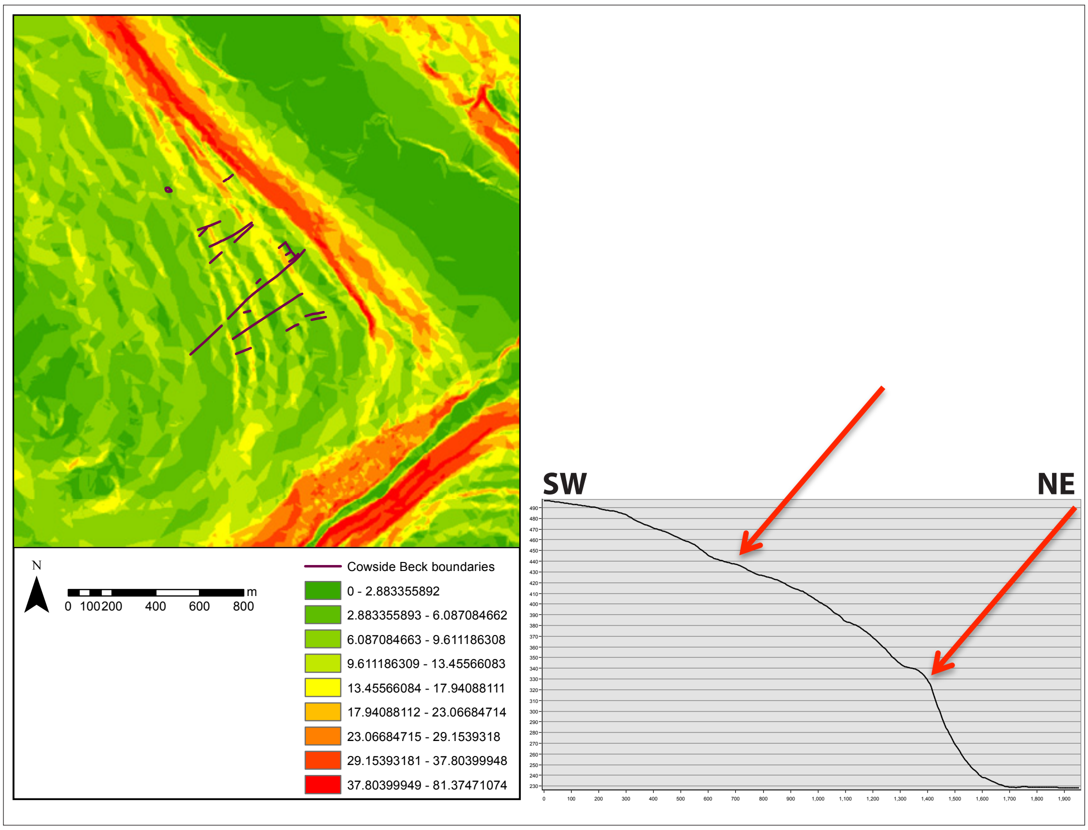


Fig. 5.11 Left: gradient plot highlighting the position of Cowside Beck coaxial system immediately above (southwest of) the steep valley side of Littondale. The gradient (percentage) plot shows the steepest areas as red and the least steep as green. Right: contour profile through the coaxial system, upper and lower extents of identifiable boundaries are marked by arrows. (Derived from OS Terrain-5 contour data.)

The natural benches of the valley sides of many of the dales, over which the coaxial boundaries run, also offer potential internal partitions (see fig. 5.12) - while the shallower scars would not stop a hungry sheep, they would serve as convenient and visible subdivisions of the coaxial strips, naturally arranged perpendicular to them, and easily augmented by a fence where necessary. Such terraces are particularly pronounced in the southern, limestone dales, whereas the dalesides of Swaledale around Reeth have a comparatively steady gradient; these northern systems also demonstrate noticeably more artificial transverse boundaries.

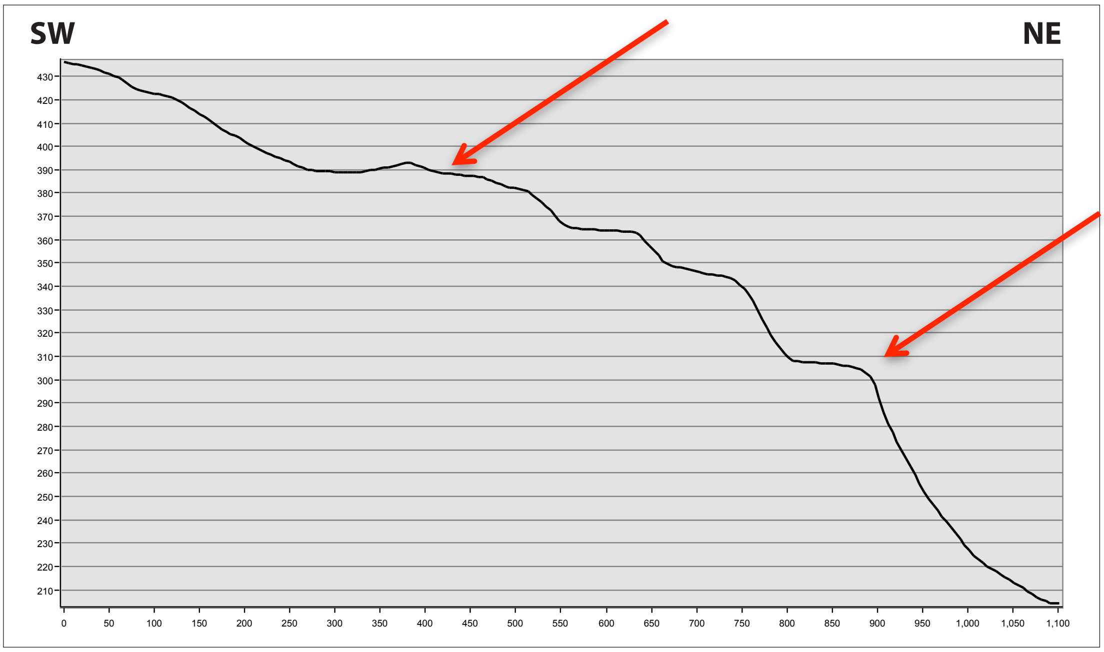


Fig. 5.12 Contour profile slice through Middlesmoor Pasture coaxial system, Wharfedale, demonstrating the stepped hillside. Upper and lower extents of system marked with arrows. (Derived from OS Terrain-5 contour data.)

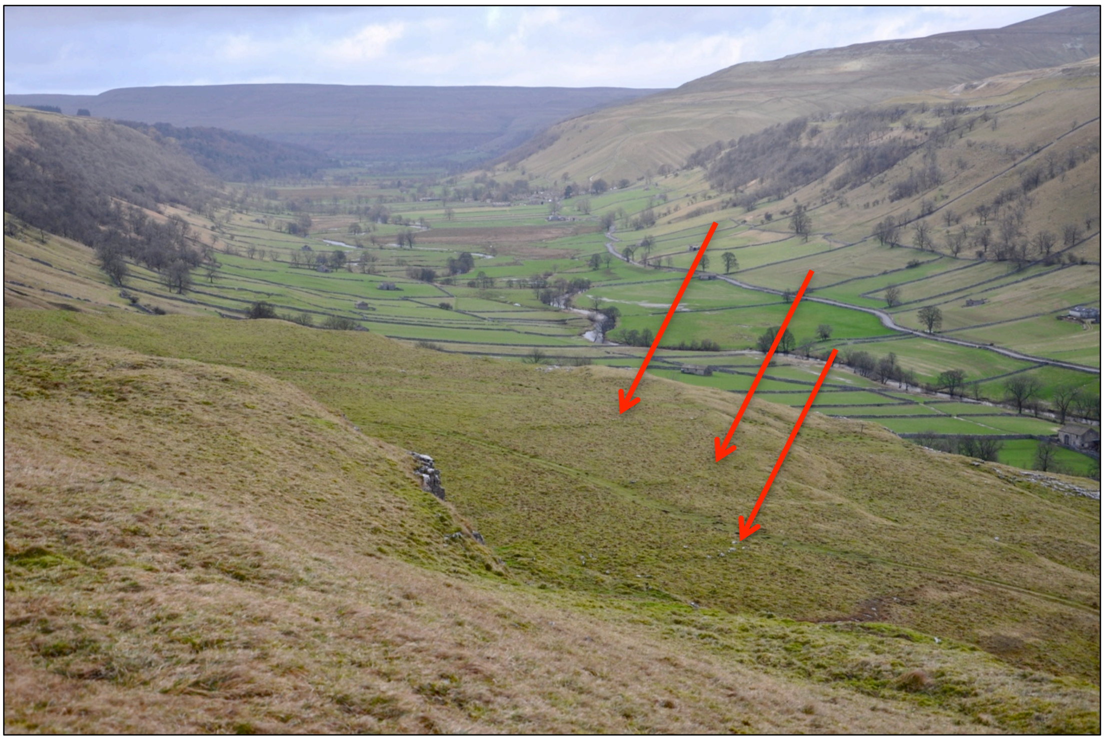


Fig. 5.13 Natural terraces at Middlesmoor Pasture on the ground, looking down from one step to another and northwest up Wharfedale (axial boundaries marked). Photo: author.

Where the axial boundaries are broken by minor scar lines, such as those at Arncliffe (fig. 4.73) or Middlesmoor Pasture (fig. 4.20), the boundaries continue above the scar, running straight up the hillside, suggesting that if the terraces were organised and worked separately, they were still part of a bigger system. Horne & MacLeod have identified staggered boundaries above and below a scar in the southern part of Grassington-Kettlewell System 2; there is also evidence for a transverse stone boundary along the top edge of the scar (fig. 5.14). It is argued that this scar represents not only internal division, but also a possible terminal for an earlier phase of the system (Horne & MacLeod 1995: 37).

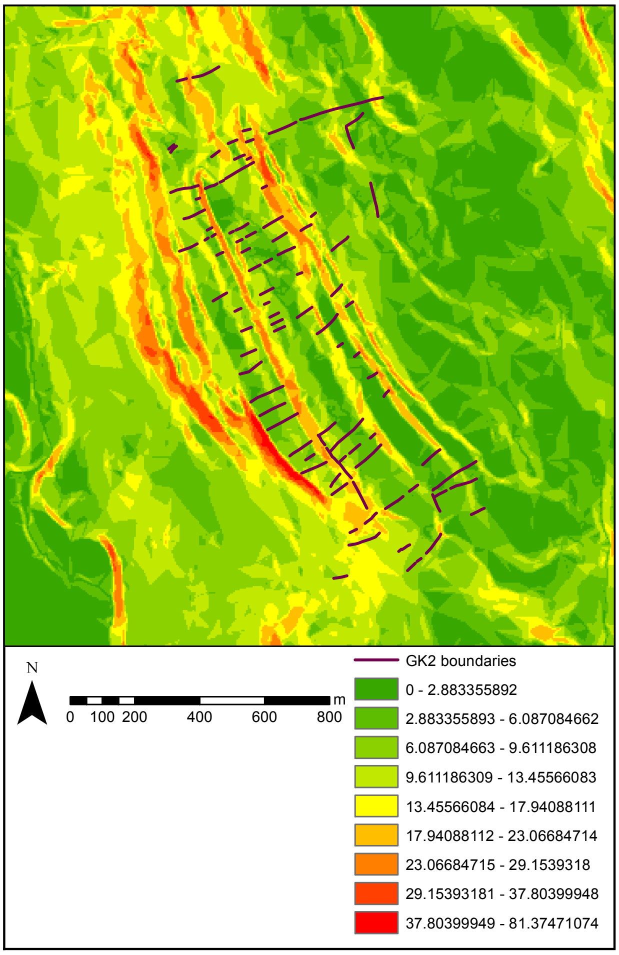


Fig. 5.14 Gradient plot with the boundaries of Grassington-Kettlewell System 2, demonstrating the series of natural terraces and the boundaries between the scars. Note particularly the transverse boundary running along one of the lower scars in the southern part of the system, with staggered boundaries either side of it. Derived from OS Terrain-5 contour data.

A further example of the use of the existing natural environment is provided within Grassington-Kettlewell system 3. As described in Section 4.4.6, the southeastern-most boundary of the system extends northeast for 1500m back from the valley side, ending on the edge of a sinkhole with a diameter of around 40m. It is assumed that the sinkhole predates the boundary. Although small sinkholes are common features of the limestone landscape in this area, this particular example is considerably larger than any other in the vicinity. The extended boundary and the alignment on the sinkhole suggest it was of some significance to the builders of the boundary. Lower down, the boundary passes close by (enclosing) a spring, which is also likely to have been of importance, both practically and symbolically. These natural features appear to have served as markers but are unlikely to have been the only cases, with the possibility of other examples that are more subtle or that had a finite life, such as trees. It is possible that they contributed to the early layout of the system (Dave MacLeod, pers. comm.).

5.2 Dates

The location of the coaxial systems in time is considerably more difficult than their situation in space, not least because of the length of use and reuse that it can be assumed all or part of the systems underwent, as well as the nature of the role of the field boundary that inherently makes it difficult to date them with great precision or accuracy. Both relative and absolute dates for coaxial systems in the Yorkshire Dales are hard to come by, with very little work having been previously conducted on the problem to move knowledge beyond general presumption.

5.2.1. Relative evidence

In a few places, the individual boundaries overlap, offering the potential for a floating chronology. Field survey as part of the Swaledale Ancient Land Boundaries Project (SWALB), has begun to pick apart some of the possibilities, identifying a limited amount of phasing (‘early’ vs ‘late’) within the Harkerside, Grinton, Reeth and Healaugh systems (Laurie *et al.* 2011). On the northern side of Swaledale, limited excavation has shown a wall of the Healaugh System to run over one of the Reeth System, with two further Healaugh System walls running up to other Reeth System walls (Fleming

2010: 142; fig. 9.2). While Fleming has concluded that the Reeth System was already there when the Healaugh System was laid out, this extrapolation from individual walls to whole systems may be oversimplifying the situation and perhaps flattening evolution that occurred through time. On the opposite, southern, side of Swaledale, Fleming has argued for a late Prehistoric date for the Harkerside System on the grounds that the western extent of the system appears to finish approximately 400m east of Maiden Castle, a late Prehistoric 'defended' site (MYD4503), as though respecting the space of the extant monument (Fleming 2010: 147), although there is little conclusive evidence for this and the situation could be the other way around.

Grassington-Kettlewell System 6 (Wharfedale) has been identified as typical of a Romano-British adaptation of a pre-existing coaxial system (Horne & MacLeod 1995: 40), with more complex patterns of enclosures and sub-enclosures clearly visible on top of the remains of the original axial boundaries; a small number of crossing points of boundaries, such as that in fig. 5.15, demonstrate, however, that the later phases of this system are unlikely to have been laid out in one episode. The presence of features such as this imply that the potential exists for deciphering a relative chronology, although this would require detailed field survey.

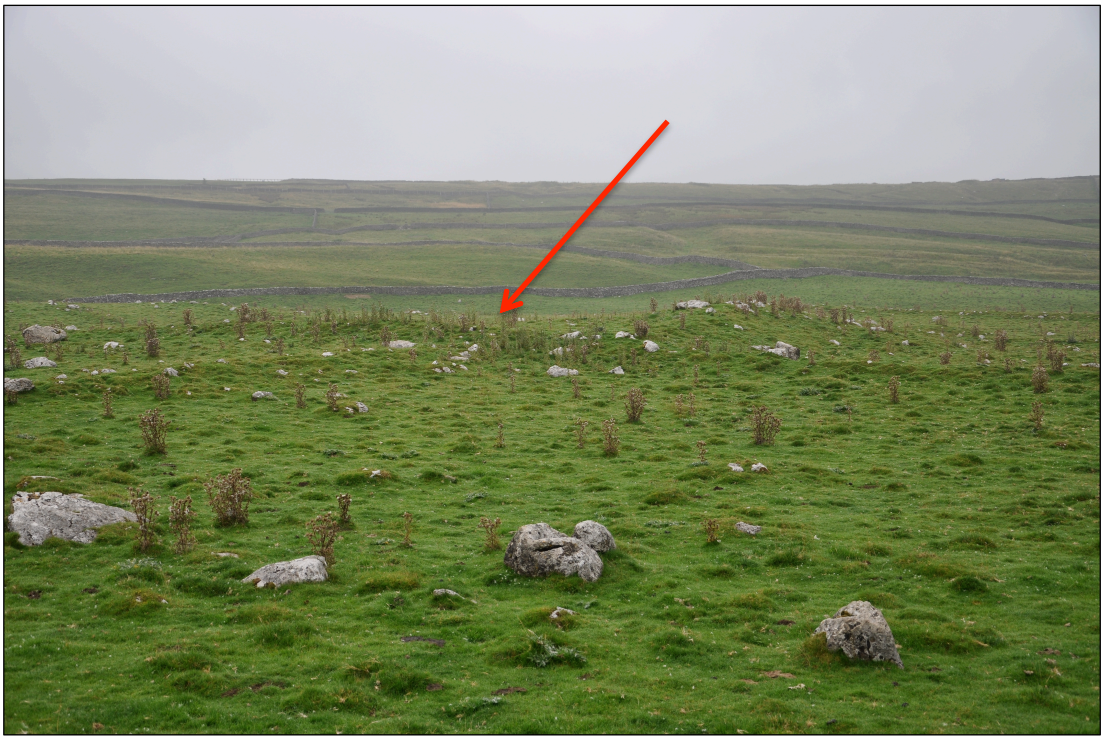


Fig. 5.15 Crossing point of boundaries of Grassington-Kettlewell system 6.

5.2.2. Absolute evidence

The only absolute dates relating to field boundaries in the Dales come from a set of radiocarbon dates obtained as part of the SWALB Project (Fleming & Laurie 1986; 1987). The samples were taken from either side and beneath one of the major axial walls on Calverside on the northern side of mid Swaledale (NGR NZ008001), below which charcoal was found during the digging of a narrow slot trench aimed at examining the structure of the wall. The charcoal formed a coherent layer to the west of the wall, where two samples returned dates of 818-391 cal. BC (two standard deviations) and 410-197 cal. BC, was more diffuse to the east of the wall, where two further samples recorded 614-391 cal. BC and 404-101 cal. BC, and was present in even smaller quantities beneath the wall, where the final sample recorded 371-37 cal. BC (Fleming & Laurie 1986: 5). These dates are problematic, both in terms of their localized representation and the bigger picture. Although, as was noted at the time, the pairs of dates from either side of the wall come from the same horizon, they can only be made to overlap at *c*.400 BC at two standard deviations. The following interpretive possibilities were offered: either to treat the two earliest dates, centred on 565 and 421 cal.

BC, as containing older wood and take the other three (overlapping for a period of over a century around 300 BC) as indicative of a burning phase with the wall built shortly afterwards, or, less preferable, to discount the date from beneath the wall and set the burning episode at around 400 BC, in which case the construction of the wall could be earlier (Fleming & Laurie 1986: 5-6). From the wider perspective, whichever date is chosen, it is only representative of the circumstances of a relatively small portion of that particular axial boundary and cannot be confidently extrapolated to apply to clearance of the rest of the system, or, necessarily, the situation of the whole boundary.

Fleming supported his conclusion that the Healaugh system was built around 300BC with evidence from a pollen core taken from Ellerton Moor (Fleming 2010: 145): further work of the SWALB Project included analysis of a pollen core of 2.6m of peat from a glacial overflow channel on the moor (located approx. 5km southwest of the Healaugh system, on the southern side of mid/lower Swaledale) (Fleming & Laurie 1991: 1). The lower part of this core featured tree pollen strongly, before a dramatic fall in tree pollen, including birch, hazel, oak and alder, and a significant rise in the pollen of plantain and six-fold increase in grasses; referred to as Episode 1, this event was bookended by radiocarbon dates of 510-380 cal. BC (1 standard deviation) and 1 cal. BC-AD 80, reflecting major clearance in the middle and late Iron Age. After a short recovery of trees at the very end of the Iron Age, the Romano-British period was characterised by major tree clearance. Small quantities of cereal pollen were present throughout. It was argued that these dates roughly coincide with those for the Calverside charcoal and provisionally suggested that “the major land division systems were laid out in the mid Iron Age, in an open landscape produced by clearance carried out perhaps not very much earlier” (Fleming & Laurie 1993: 5). Although this work illuminates the locality, similar reservations to those related to the radiocarbon dating of the ‘clearance’ charcoal apply, with difficulties in extrapolating from samples to a greater general area (see Rushworth 2010).

5.2.3. Post-prehistoric use of fields

There is little direct evidence for later reuse of the coaxial systems. Just as the chronology of their appearance is difficult to pin down, their fall out of use is difficult to specify and is likely to have been gradual and their reuse intermittent. Arguably, their lifespan still continues, in that their stone has been recycled into the modern drystone walls. It is worth bearing in mind that it is not necessarily clear whether or not we are considering representative samples: it is conceivable that these systems are those that fell out of use, for whatever reason, while the 'successful' ones continued to develop elsewhere with the result that their prehistoric phase is now more difficult to identify. With this in mind, it is worth observing that the medieval agriculture in the dale bottoms follows the same alignment as most of the prehistoric boundaries and targeted excavation of field walls there may reveal older origins. If not, it remains notable that an apparently similar approach to dividing up resources was taken at a later date - and a similar approach often taken by the more recent Enclosure boundaries higher up the hillsides (Whyte 2003: 63). It is also interesting to speculate that, as many of these fellsides and pastures were held by the great northern monasteries during the Middle Ages, the prehistoric boundaries may have been reused during this period as part of their highly organised management of the land for sheep grazing - Fountains Abbey, for example, held extensive grazing rights around Conistone, Kilnsey and Malham (Lancaster 1915) - which may have contributed to their preservation.

5.3 System layout

5.3.1 Terminal and transverse boundaries

In Fleming's search for a pattern among the reave systems of Dartmoor, he differentiated between the parallel axial reave systems and the single reaves running at right angles to them. The concept of the latter, which Fleming termed the 'terminal' reave, was "clearly a primary organisational principle of ancient land division on Dartmoor" (Fleming 2008: 48), and served to integrate the axial reaves which typically ended on this terminal boundary.

Horne & MacLeod looked specifically for such features in the aerial photography transcription data of the Yorkshire Dales in the National Mapping Pilot Project, but concluded that evidence for such built terminals was rare (Horne & MacLeod 1995: 35). Table 5.1 draws on their findings, with additional evidence from more recently identified coaxial systems, to demonstrate the prevalence of these features.

Table 5.1 The prevalence of transverse boundaries and terminal boundaries among coaxial systems of the Yorkshire Dales. Based on Horne & MacLeod 1995: 33-4, table 4.1.1.6 with additional information.

	Transverse Boundaries	Lower Terminal	Upper Terminal
Middlesmoor Pasture	Natural	Natural	
GK1	Natural	Natural	
GK2	Natural	Natural	
GK3			
GK4	Natural; yes		
GK4a		Natural	
GK5			
GK6	Yes	Natural	
Kilnsey 1	Yes		Natural
Kilnsey 2	Natural; yes		Yes
Halton Gill	Natural		
Cowside Beck		Natural	
Arncliffe	Natural		
Horton	Natural	Natural	
Stainforth	Natural	Natural	
Settle			Natural
Carperby 1		Natural	Natural
Carperby 2		Natural	
West Burton		Natural	Natural
Low Row Pasture			?Natural

Healaugh	Yes	Yes
Reeth	Yes	Yes
Harkerside	Yes	Yes
Grinton Moor	Yes	

Four upper terminal reaves are known, three of which are located in Swaledale systems, the exception being Kilnsey 2, located in a small tributary valley off Wharfedale. Among the Swaledale systems it is noticeable that what are interpreted as the terminal boundaries are not as direct as those on Dartmoor (or, at least, the impression given by the mapping thereof), but are comprised of a number of slightly staggered sections, each forming the upper terminal to one or more coaxial strips. In places, as demonstrated in the Harkerside system (fig. 4.113), the axial boundaries appear to continue above what is presumed to be the 'terminal' boundary, while elsewhere, in the Healaugh system, the terminal boundary respects an earlier, roughly circular, enclosure (see fig. 4.105). The most coherent length of terminal boundary, measuring around 570m, continues west from the western extent of the Harkerside system, towards the late prehistoric remains of Maiden Castle (fig. 5.16), although no coaxial strips are attached to it at this point. In the Reeth system (fig. 4.109) the upper boundary is less discernable, running into smaller enclosures in the northeastern portion of the system, perhaps suggesting an upper boundary that was exceeded at a later date as the system was extended. Four, possibly five, of the remaining systems appear to have natural topographic features, namely scars, taking the place of a built upper terminal boundary, as described in Section 5.1.2. Where no upper terminal is apparent, the systems fade out in the high moorland, perhaps being covered by peat in places.

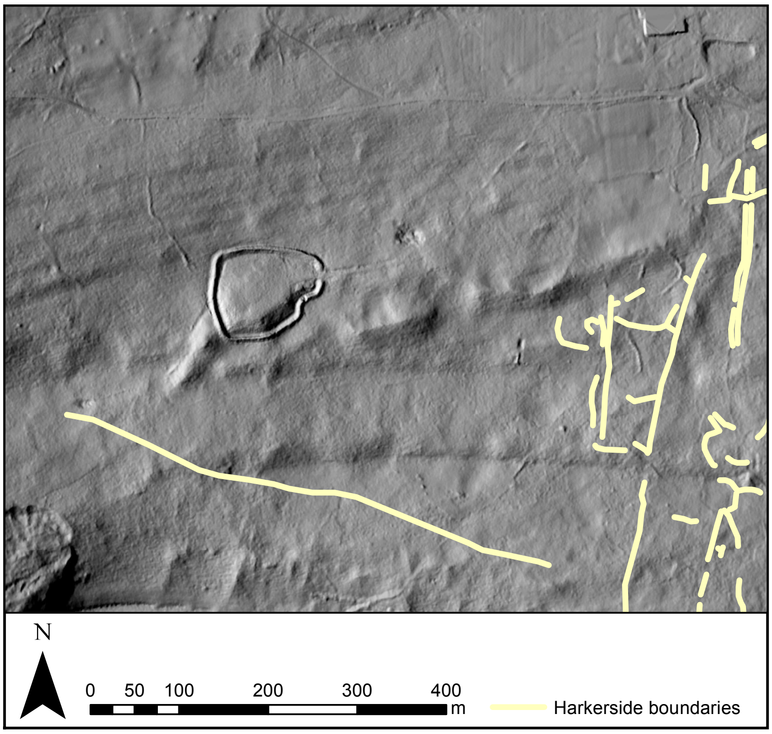


Fig. 5.16 Lidar hillshade plot of Maiden Castle, Swaledale, with the addition of boundaries of the Harkerside system, illustrating an apparent section of terminal boundary extending west beyond the main system. (Angle of light source 40º, azimuth 315º. Generated from Environment Agency lidar data.)

In approximately half of the systems, scars coincide with their lower extremity, separating the system from the lower valley sides. In cases where such a topographic feature is not present - including Swaledale, which has significantly fewer limestone outcrops than the southern dales and, consequently, a more uniform gradient to the valley sides around Reeth - the coaxial strips merge into the enclosed farmland of the current daleside landscape, becoming less visible as the pasture is more improved. It is likely that in such cases as the Settle system (fig. 4.86) the lower walls were reused in the medieval period, making it difficult to differentiate between the original walls and the later extensions.

As with the terminal boundaries, the majority of the observed features presumed to serve as transverse boundaries are natural rather than artificially built. As mentioned in Section 5.1.2, a number of the systems appear to utilize existing limestone terraces as internal transverse divisions. This is supported by the Kilnsey 2 system, which appears to show a short section of built boundary completing a transverse division formed primarily by a limestone outcrop (fig. 5.17).

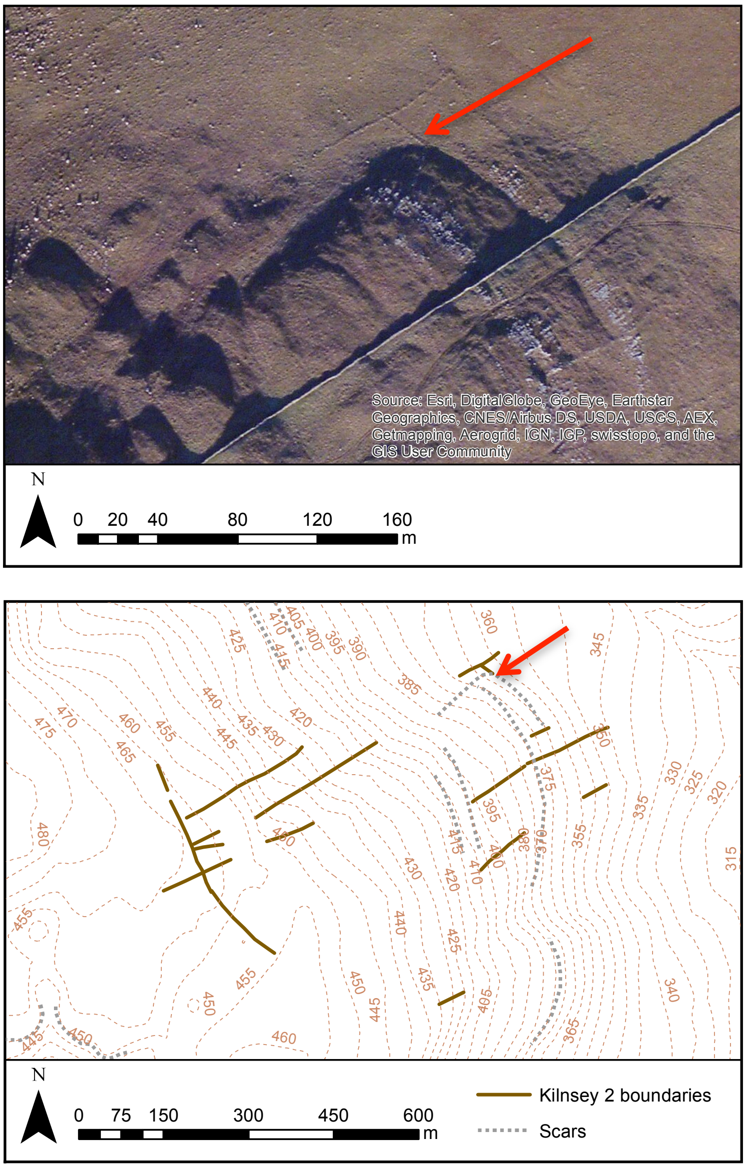
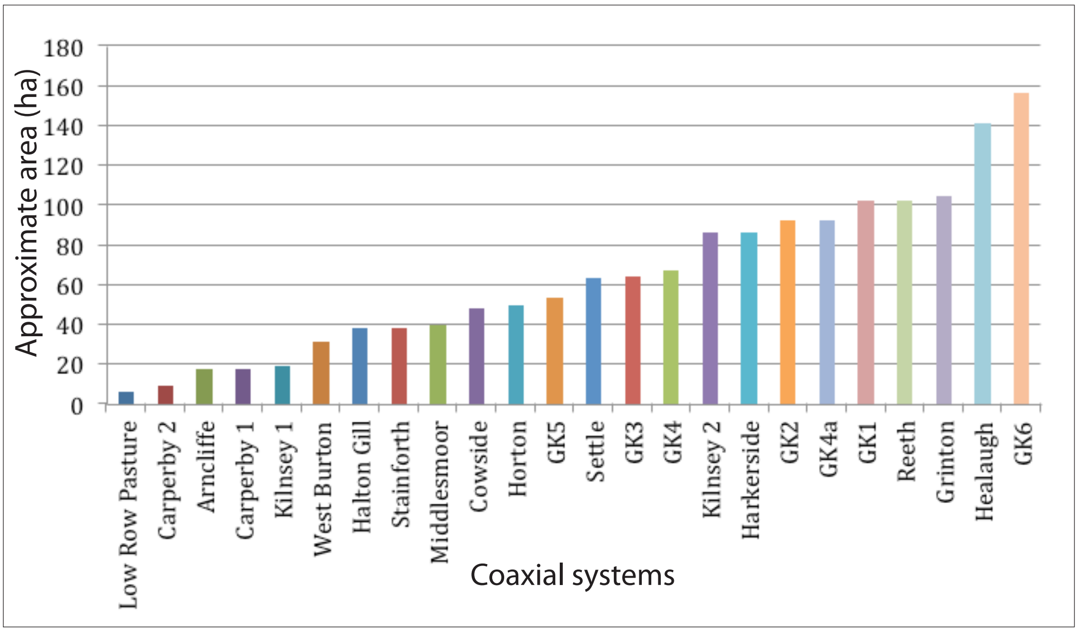


Fig. 5.17 Kilnsey 2 coaxial system, highlighting the use of scars and artificial transverse boundaries.

5.3.2 System dimensions

The difficulties of quantifying the extents of the field systems, given the variables of preservation, have been touched on above, but figs. 5.18 and 5.19 give an indication of the range of measurements involved. It is apparent that the project has identified a total of just over 123,000km of field boundaries within the Yorkshire Dales National Park, extending over approximately 1500 ha. The largest individual system, Grassington-Kettlewell

6 (Wharfedale), covers around 156ha, while the smallest, Low Row Pasture (Swaledale), covers a minimum of 6ha - it is, of course, highly likely that further primary boundaries or less pronounced internal divisions survive beneath the surface or obscured by vegetation, increasing the complexity of the systems. The greatest concentration of boundaries in any given valley is seen in Wharfedale (although a large part of Swaledale is outside the national park), where they cover a total of 2192ha. The smallest concentration - by area and length of boundaries - is found in Wensleydale, in disproportion to the size of the dale. Fig. 5.18 demonstrates that systems have a range of area, with a slight cluster of frequency around 80-100ha. Likewise, fig. 5.19 shows a spectrum of total lengths per system between 0.479 km (Low Row Pasture, Swaledale) and 13.058 km (Harkerside, Swaledale); the obvious exception to this pattern is GK6 (23.805 km), which can be explained by its dense Romano-British reuse (see Section 4.4.9). Those systems that occur in Wharfedale and Swaledale are, on the whole, large relative to the mean, although this, particularly in Swaledale, may be the result of previous study.



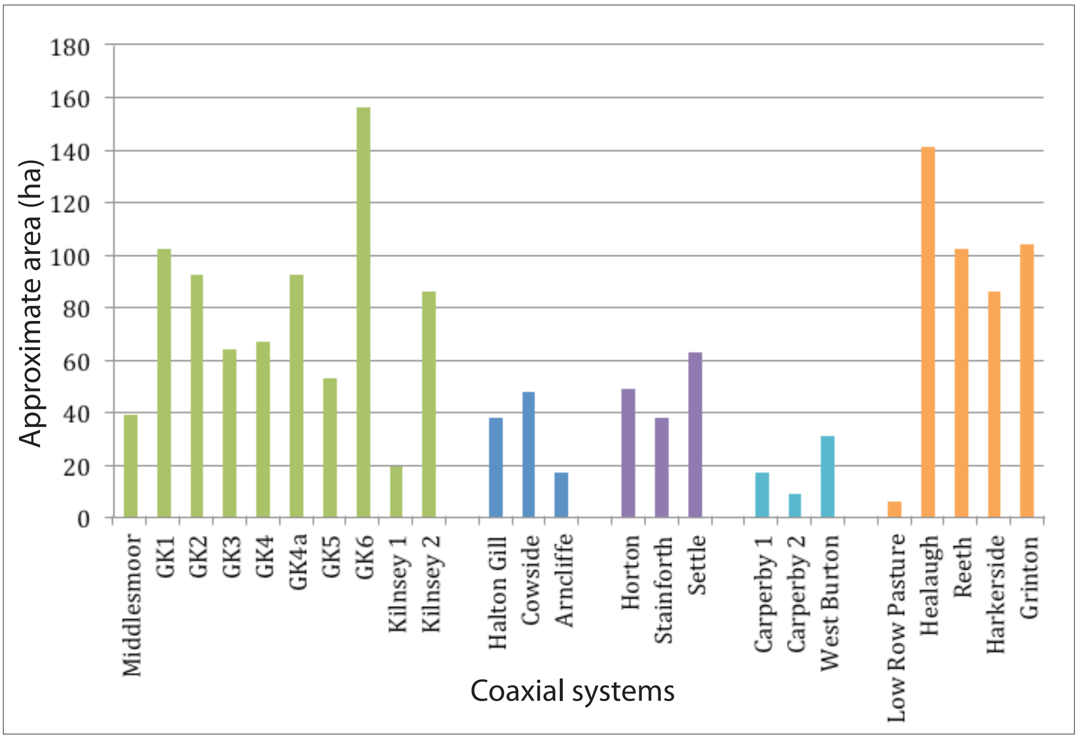
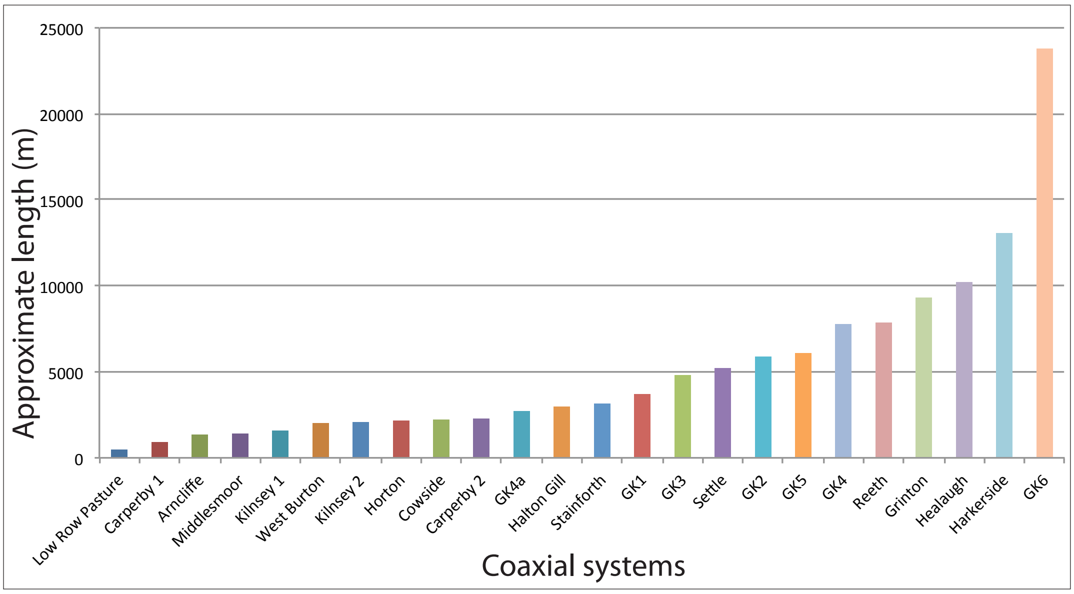


Fig. 5.18 Approximate area (in hectares) of individual coaxial systems in the Yorkshire Dales National Park, arranged by magnitude (above) and dale (below).



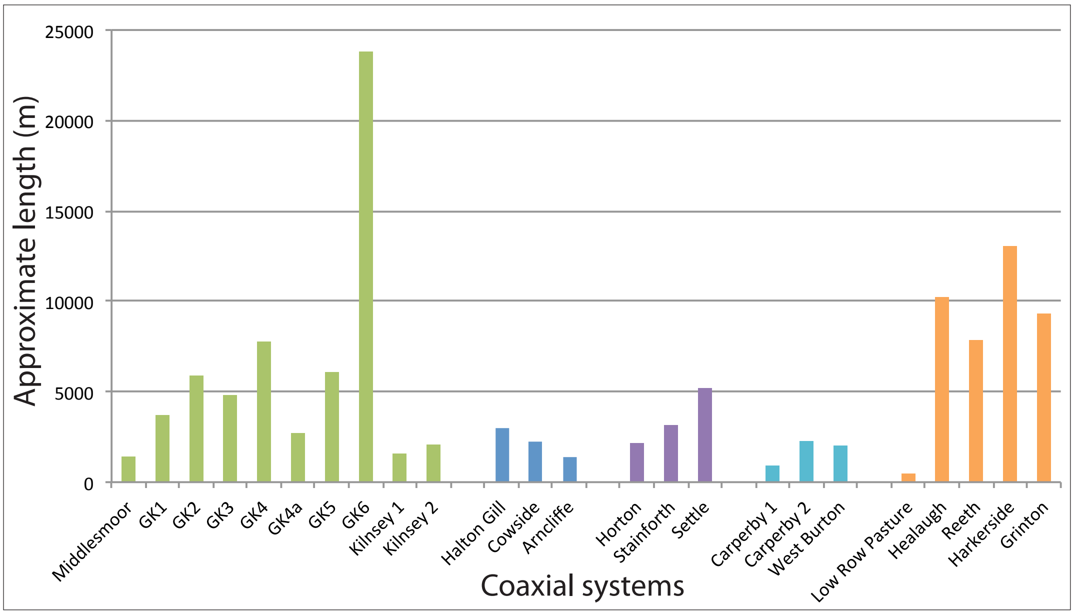


Fig. 5.19 The approximate total length (in metres) of boundaries in each field system for coaxial systems in the Yorkshire Dales National Park, arranged by magnitude (above) and dale (below).

5.3.3 'Density' of boundaries

A calculation of the 'density' of the boundaries in a system has been used as a means of roughly comparing landuse, in theory comparing the size of enclosures between systems. 'Density' has been taken as the length of (known) boundaries per unit area of the system. So, for example, the Stainforth coaxial system covers an area of 38 hectares and has a total of 2.403 km of measureable boundaries, therefore a density of 63 metres per hectare. This value allows for comparison between systems while overcoming the variable of absolute area.

The area of the systems has been measured by applying an arbitrary 30m buffer around the extent of the digitized boundaries (and filling in ‘inlets’ manually). The total length of boundaries and total area of each system were then obtained from the GIS feature attribute table (see Table 4.1). A scatter plot of the ratio of area to length of boundaries *i.e*. density, was then created, followed by a bar chart of the same data, to determine any relationship between the systems (figs. 5.20 - 5.21).

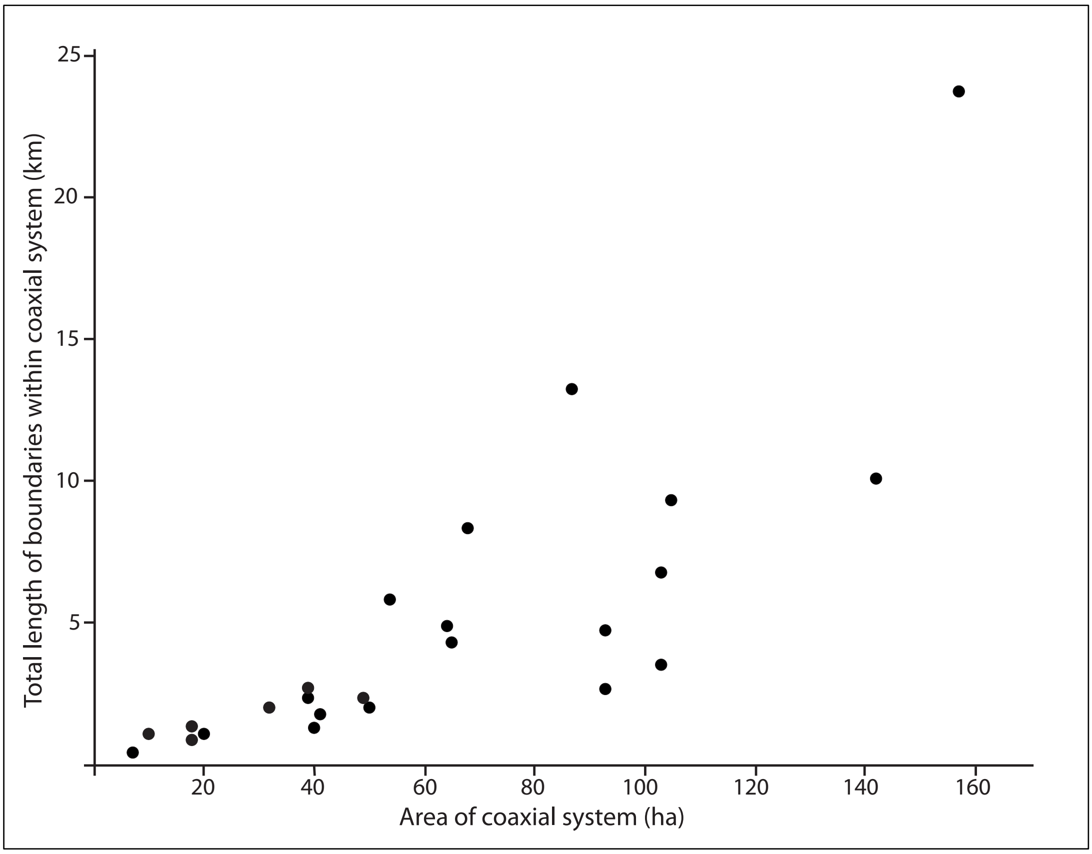


Fig. 5.20 Scatter graph to show the relationship between boundary length and area.

At the most basic level, the scatter graph shows that, on the whole, the greater the system area, the more boundaries are present. This is to be expected, however, it may not necessarily be the case if substantially different rates of preservation were involved.

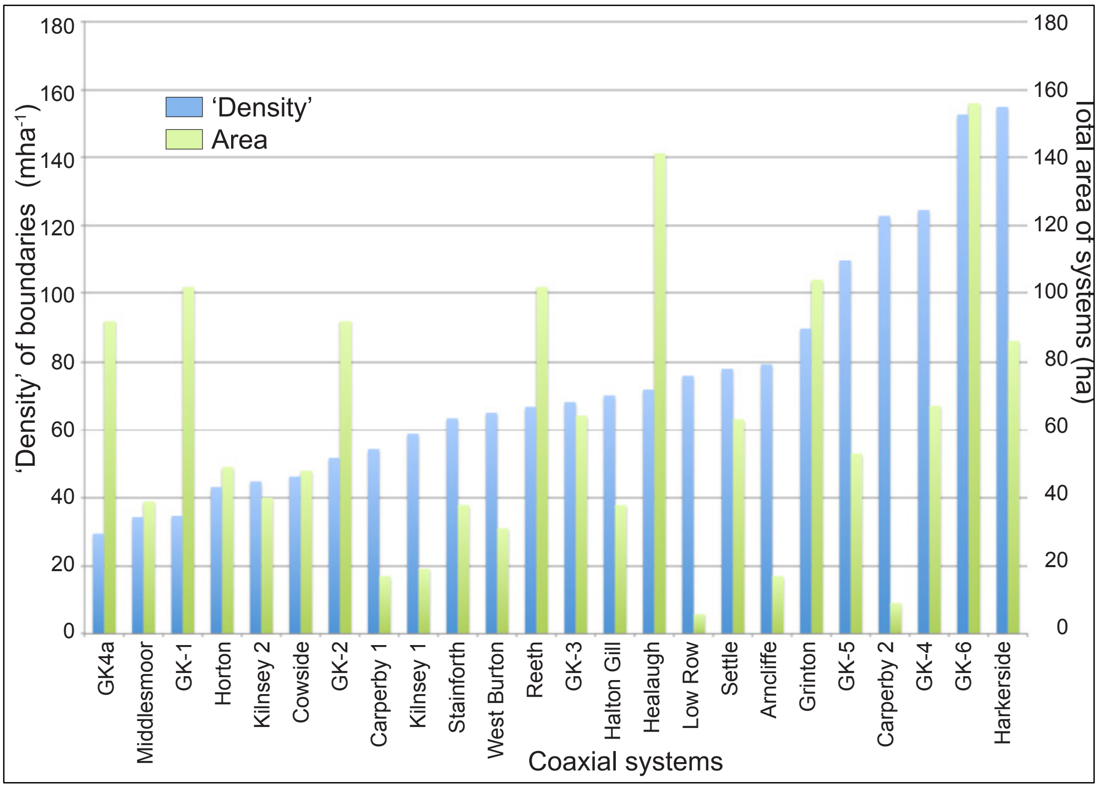


Fig. 5.21 A comparison of the 'density' of boundaries in each system, plotted alongside total area of each system.

It is apparent from fig. 5.21 that the boundaries of the systems are not all equally dense. The density varies, with the most dense collections of boundaries being around five times as dense as the least dense. The densest systems include Harkerside (155mha^{-1}), Grassington-Kettlewell 6 (153mha^{-1}) and Grassington-Kettlewell 4 (125mha^{-1}). In the case of Harkerside, this density can be explained by the presence of extensive fragments of settlement evidence and small subcircular enclosures within the system, which has been surveyed on the ground and in greater detail than the majority of other systems (Laurie *et al.* 2011). Grassington-Kettlewell 6 shows extensive evidence of remodelling and reuse in the Romano-British and probably Medieval periods (Horne & MacLeod 1995: 40), which has resulted in internal subdivision of enclosures. Grassington-Kettlewell 4 also appears to demonstrate more than one phase of use. At the other end of the scale, the remains of Grassington-Kettlewell 4a (30mha^{-1}) are particularly fragmentary.

The total area of each system has also been plotted on this graph in order to emphasize the lack of relationship between density and area. Limitations of the dataset should be borne in mind: it is based on assumed equal preservation rates in the different systems, and is also subject to errors generated as a result of the scale at which the boundary remains were originally digitized. It is, of course, likely that further boundaries existed that are no longer visible and have not been taken into account here.

On closer inspection of the scatter graph, the results appear to be loosely grouped geographically (fig. 5.22). The reason for this is not clear, although it may relate to relative preservation, topographic disparity or perhaps cultural variation between valleys. It is not the case that the largest and/or densest systems are found in the biggest valleys - the dearth of boundaries (see also fig. 5.19) in Wensleydale suggests otherwise - and there is some variety within each valley, but the calculated densities for each dale fall close together on the graph.

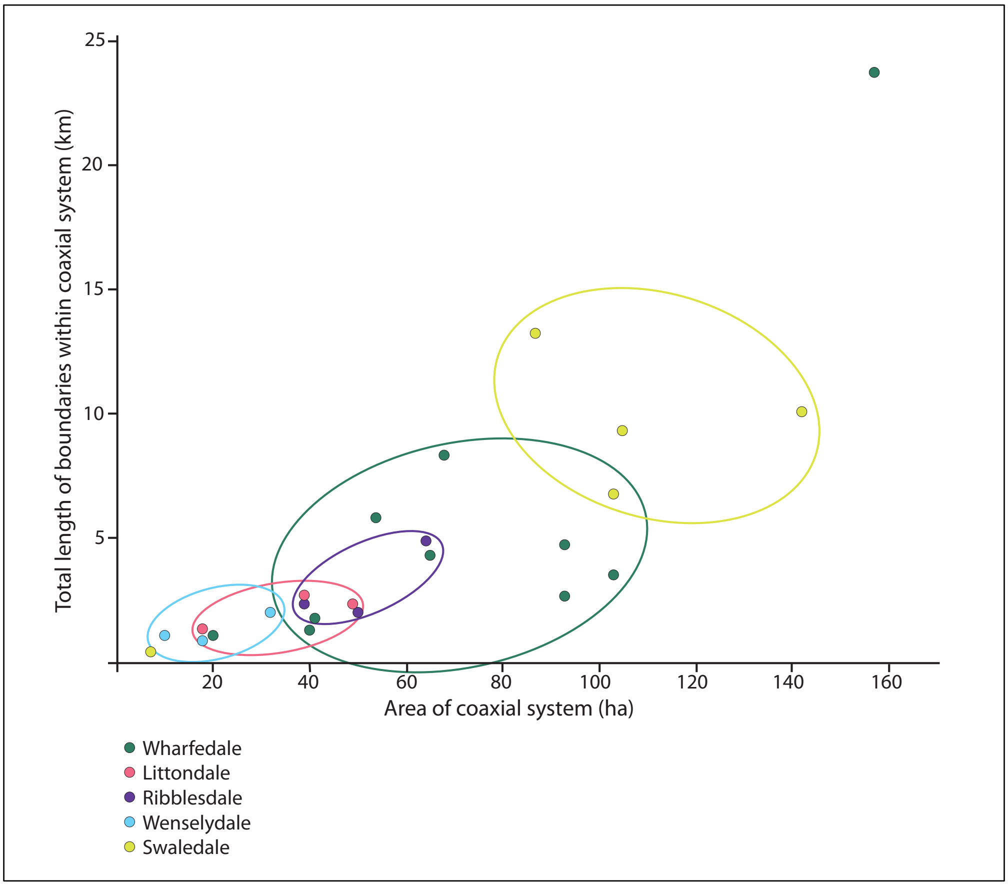
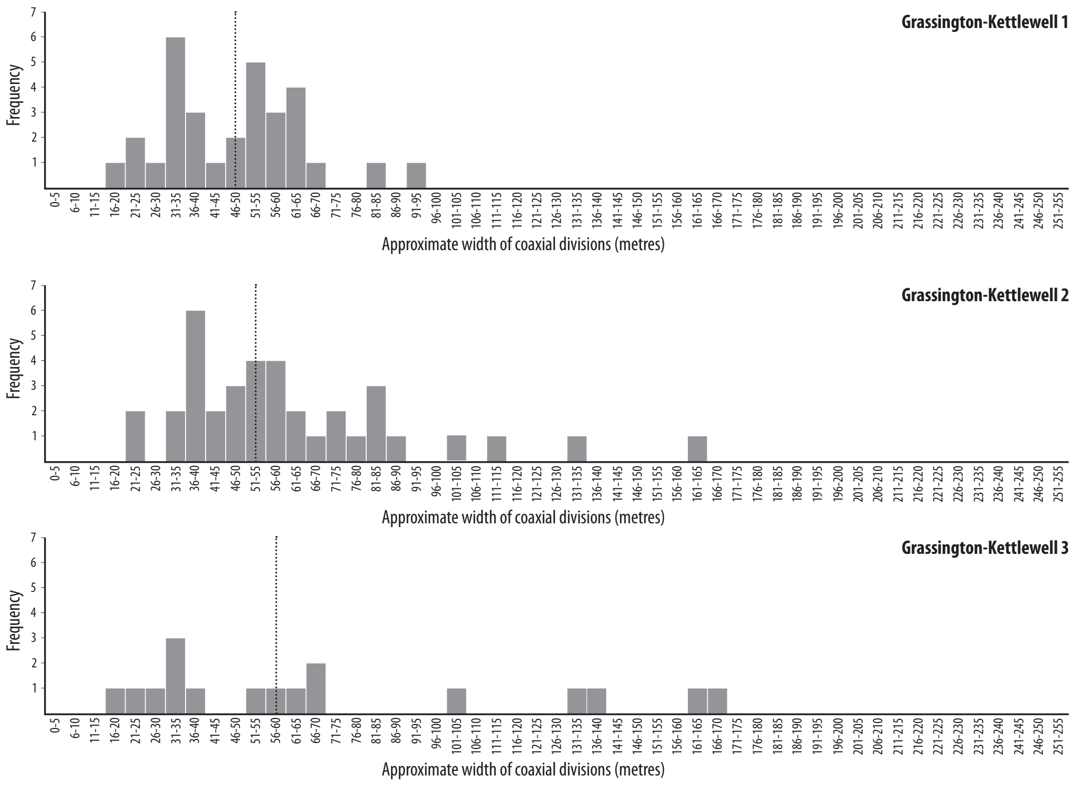


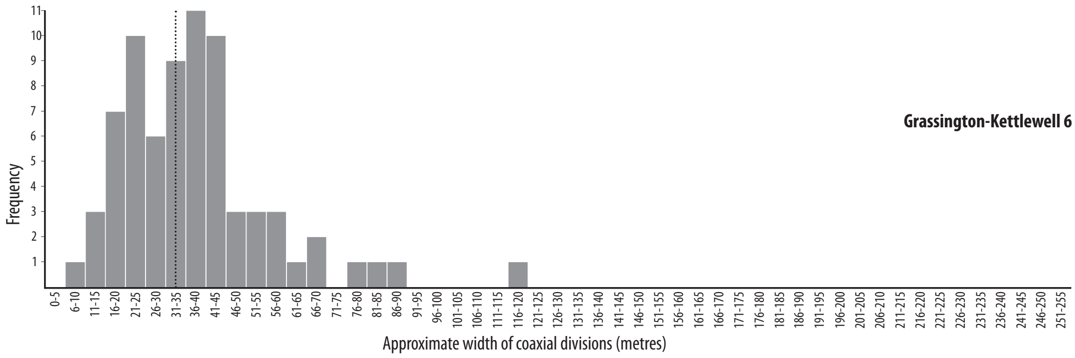
Fig. 5.22 'Density' of boundaries: area of coaxial systems plotted against the total length of identifiable boundaries in the system. Outliers include

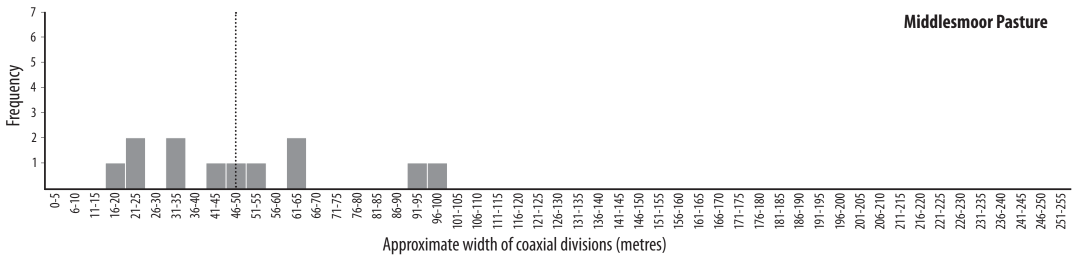
Grassington-Kettlewell 6 (top right; radically remodelled) and Low Row (bottom left; possibly truncated).

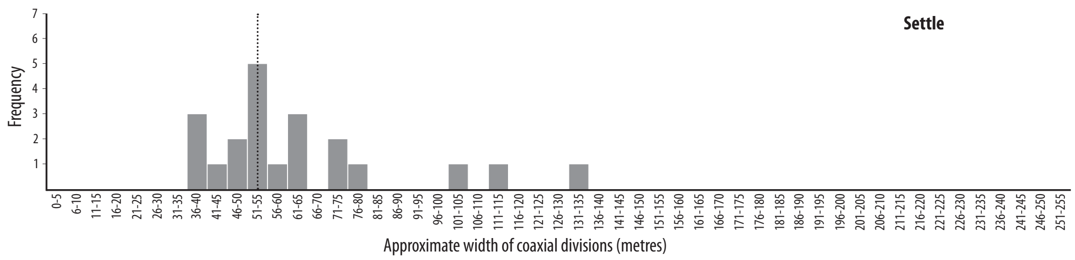
5.3.4 Frequency of boundaries

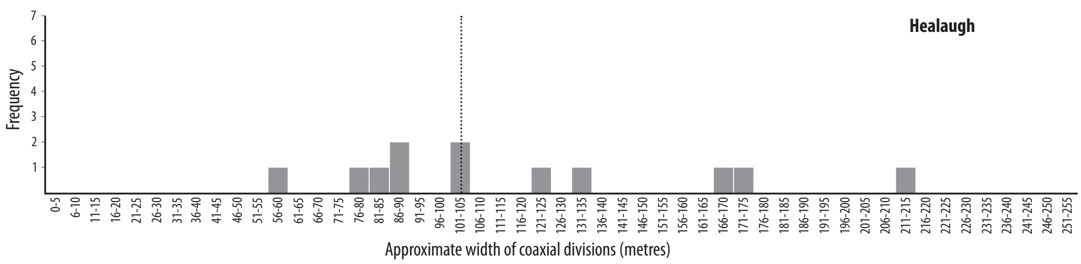
Coaxial landscapes bring to mind large scale, regular division of land, which raises the question: how regular *are* the divisions? Is there a standard unit of distance between the boundaries? The aim of this analysis was therefore to identify any underlying units of measurement common in the widths of the strips. The bar charts in fig. 5.23 show the range of distances between coaxial boundaries in various systems. See Appendix 3 for further examples.

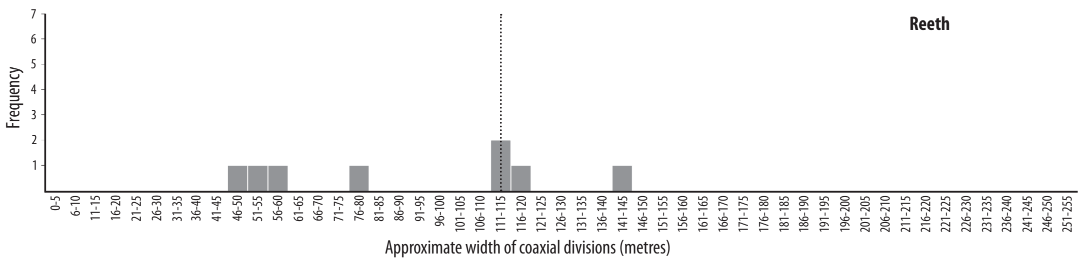


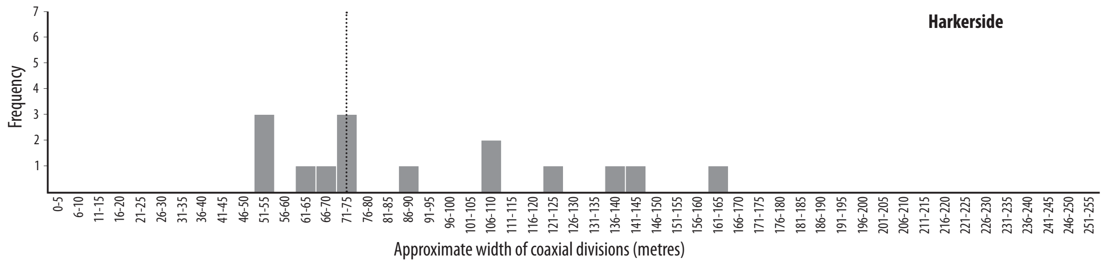

Grassington-Kettlewell 6
Frequency
Approximate width of coaxial divisions (metres)


Middlesmoor Pasture
Frequency
Approximate width of coaxial divisions (metres)


Settle
Frequency
Approximate width of coaxial divisions (metres)


Healaugh
Frequency
Approximate width of coaxial divisions (metres)


Reeth
Frequency
Approximate width of coaxial divisions (metres)



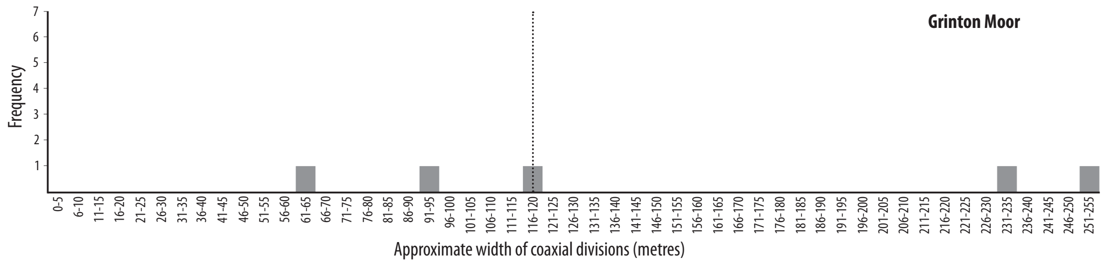


Fig. 5.23 The relative range of distances between boundaries. The median distance is shown by a dotted line.

The individual strip measurements were measured from the digitized boundaries within the GIS environment, taking a mean of three widths perpendicular to the axial boundaries at different places in order to minimize measurement error. However, an element of error must exist, caused by fragmentation of the systems: measurements were made between all existing boundaries such that no allowance was made for absences *i.e*. in an unknown number of cases, the distance between two axial boundaries was measured when at least one, possibly several, axial boundaries would have originally run between them. Further sources of error within the data stem primarily from the scale at which boundaries were originally digitized (see Chapter 3) and from measuring distances on the 'flat' digital map, rather than taking the rugged terrain into account. These errors are relatively small, but might render a very small unit of, say, 1 or 2 metres, undetectable.

Perhaps the most noticeable feature of the bar charts is the spread of strip widths recorded within each system. For example, in the Healaugh system, where 12 distances were measured, the width of coaxial divisions varies between 56m and 215m, with little repetition; this pattern is also true of the other systems in Swaledale. This may be related to their lack of visibility due to heather cover, although they have been surveyed on the ground in detail (Laurie *et al*. 2011). The spread is less obvious but still apparent, for example, in the Grassington-Kettlewell systems, where the spread is between 16 and 95m (Grassington-Kettlewell 1) around a mode of 31-35m, whereas an example such as Settle shows a range from 36 to 80m around a mode of 51-55m, with outliers of up to 135m. The reuse undergone by Grassington-Kettlwell 6 is reflected in the high number of measurements taken and the bias towards narrower (subdivided) strips.

Plotting the median values for each system (figs. 5.24 - 5.25) still shows a range of distances between boundaries from 26 to 100m, the most frequent being between 56-60m. These graphs suggest that there is not an overall regular unit, although there is a tendency for strips to be around 30 to 60m wide.

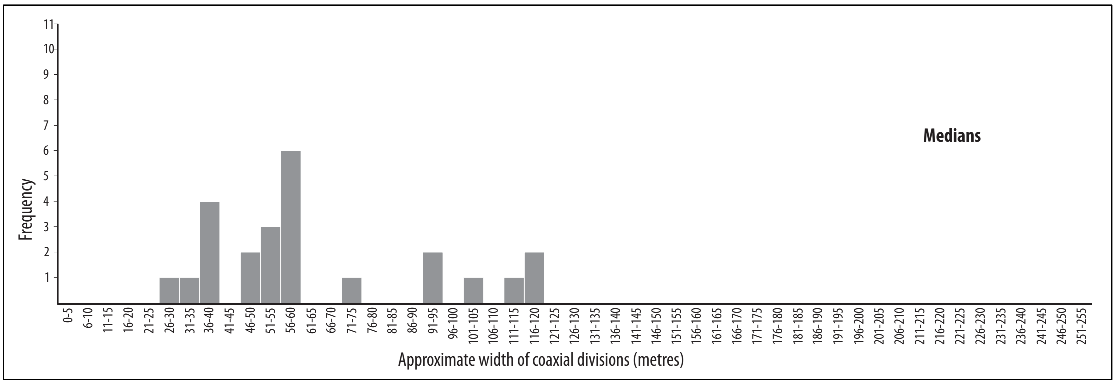


Fig. 5.24 The frequency of median values of approximate coaxial division distances for all systems. This shows a range of strip widths, with a tendency towards strip widths of around 30-60m.

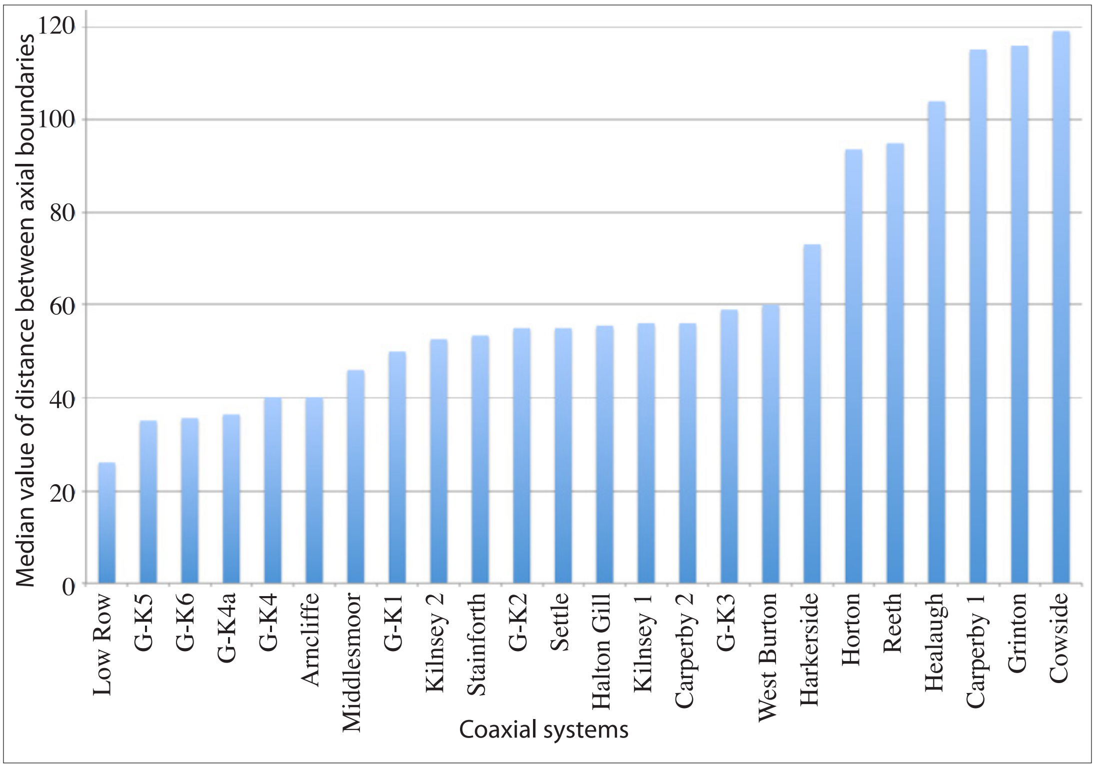


Fig. 5.25 The variation in median values of distances between axial boundaries across the systems.

There is not necessarily any reason why there should be a set unit of division within an individual system, let alone a shared one between systems. Such a layout could be interpreted as an indication of egalitarian allocation of land or an approximate manageable unit of clearance, but an absence of a defined unit does not necessarily indicate the opposite, and probably reflects a complex and possibly very flexible response to a complex topographical situation, with additional chronological variation. Some variation might reflect an irregular unit of measurement, such as a pace, although the great diversity suggests this is unlikely. Looking for a standard unit also assumes a standard in the quality of the land surface and resources, whereas a flexible, quality-based unit, comparable to, say, the Anglo-Saxon or Anglo-Norman hide (based on the area of land that would support a household or produce a given worth of income per year respectively) would inevitably produce a more nuanced - and less easy to recognize - result.

5.4 Aspect and orientation

5.4.1 Aspect

Aspect, the direction in which the land is facing, is known to have not only practical repercussions for usage - it contributes greatly to the quantity of insolation and degree of shelter and therefore the growing conditions of crops and animals - but can also be the subject of cultural preference. The result of glacial erosion and layered underlying geology, extensive and very localized variation occurs both across the National Park and within coaxial systems, with numerous deep valleys, terraced hill sides and outcrops of harder rock significantly complicating terrain. Using OS Terrain-5 contour data, it is possible to show this variation (figs. 5.26 - 5.27).

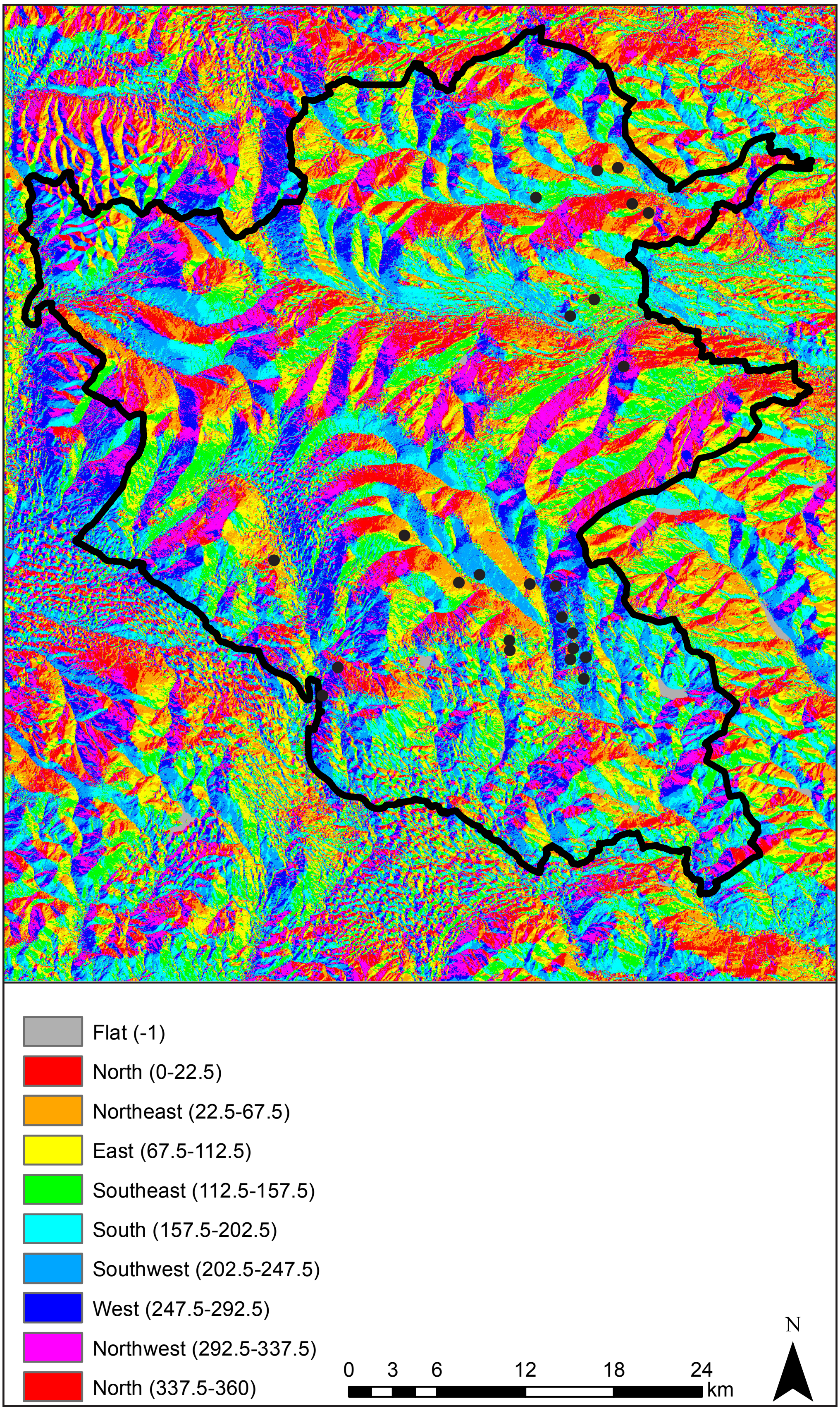


Fig. 5.26 Background values: aspect analysis across the national park, showing a high level of localized variation. Derived from OS Terrain-5 contour data.

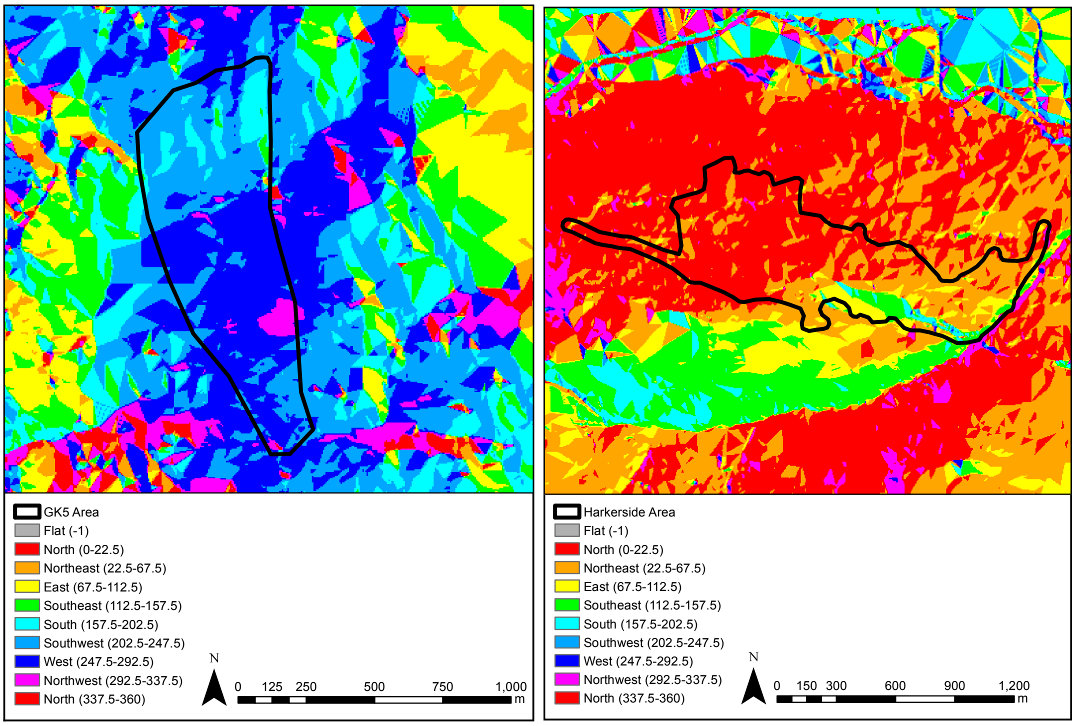


Fig. 5.27 Left: aspect variation within the Grassington-Kettlewell 5 coaxial system. This area is categorized below as having a primary aspect of west and secondary aspect of southwest. Right: aspect variation within the Harkerside coaxial system. This area is categorized below as having a primary aspect of north and secondary aspect of northeast. (Derived from OS Terrain-5 contour data.)

Plotting the known coaxial sites in relation to the aspect map shows little obvious correlation between coaxial sites and the aspect of the land on which they are situated. However, when plotted as a ray diagram (fig. 5.28), it is apparent there are fewer north facing sites. Due to the local topographic variation, each system was categorized by both the primary aspect of land within its extent and also by the second most frequent direction (this was often very close in terms of area) - see Table 5.2 below. This was then plotted as a ray diagram such that each ray represents the frequency with which that direction occurs in the table.

Aspect alone seems unlikely to be responsible for the choice of sites, though orientation of the valley systems complicates the issue. While there does not appear to be a shortage of north facing land, much of this forms the southern side of Wensleydale - one of the most open and agriculturally accessible dales in more recent times - raising the possibility that systems have been lost (although if this were the case, loss of systems from the northern side of Wensleydale should also be expected, altering the balance of distribution again). On the other hand, it is conceivable that north facing pastures were avoided as less conducive to both arable and pastoral farming as a result of generally lower levels of insolation and temperatures manifesting as poorer growing conditions and animals with greater propensity to conditions such as foot rot.

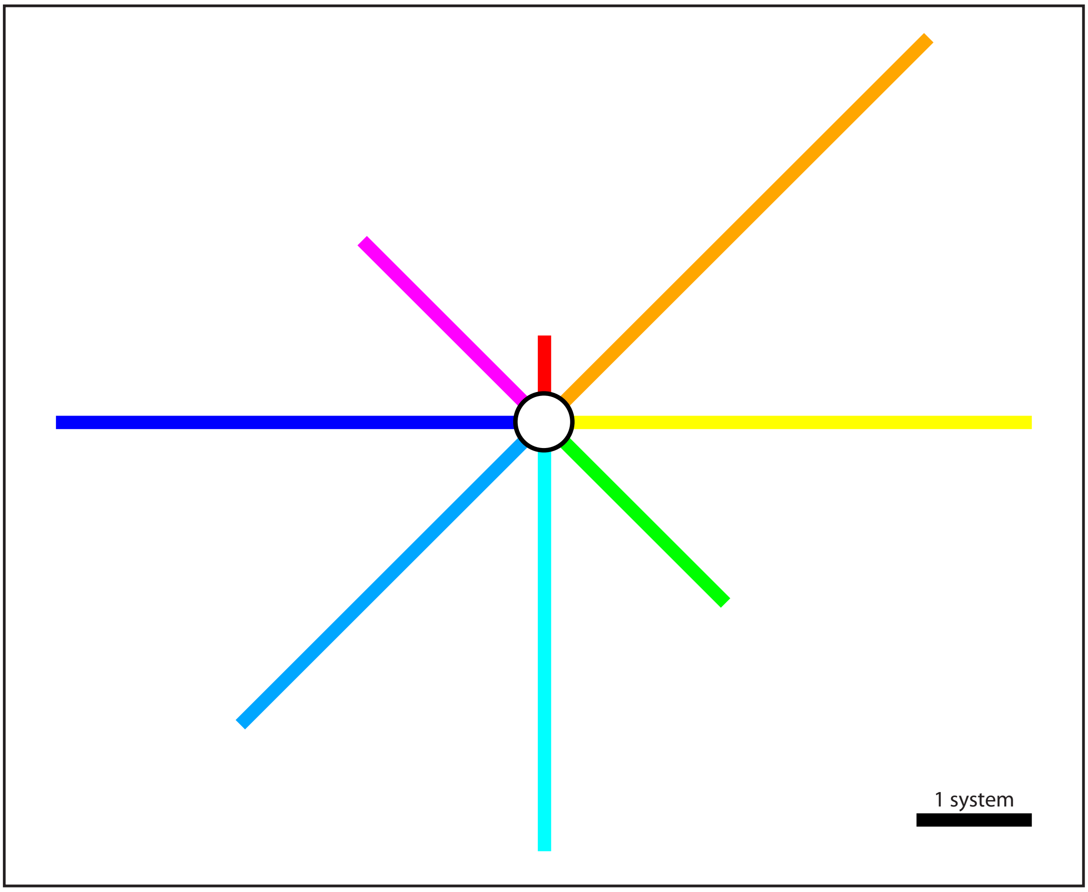


Fig. 5.28 Ray diagram showing predominant aspects of land chosen for coaxial systems (2 major directions by area plotted for each system).

5.4.2 Orientation of boundaries

Table 5.2 The primary and secondary aspect directions compared with the modal boundary orientation of each system.

	Primary aspect	Secondary aspect	Modal Boundary Orientation 1-180º
Middlesmoor	NE	E	63º NE/SW
GK1	W	SW	85º E/W
GK2	SW	W	64º NE/SW
GK3	SW	S	39º NE/SW
GK4	SW	S	36º NE/SW
GK4a	SW	E	51º NE/SW
GK5	W	SW	46º NE/SW
GK6	S	SW	48º NE/SW
Kilnsey 1	E	SE	137º SE/NW
Kilnsey 2	NE	E	58º NE/SW
Halton Gill	NE	E	59º NE/SW
Cowside Beck	NE	E	48º NE/SW
Arncliffe	SW	S	40º NE/SW
Horton	E	NE	79º E/W
Stainforth	NW	N	78º E/W
Settle	W	NW	104º E/W
Carperby 1	NW	W	176º N/S
Carperby 2	S	W	125º SE/NW
West Burton	E	SE	133º SE/NW
Low Row Pasture	S	SE	169º N/S
Healaugh	S	SW	21º N/S
Reeth	NE	E	129º SE/NW
Harkerside	N	NE	31º NE/SW
Grinton	NE	N	24º NE/SW

Against a relatively flat topographic background, the direction in which the boundaries themselves are orientated could be governed by cultural principles associated with land layout. Given the topography in the Dales, this would be more challenging (and more difficult to recognise), but not necessarily impossible. By taking the length and azimuth of each boundary and plotting them as ray diagrams for each system, comparisons can be made and commonalities looked for.

The direction of each boundary within a given system was measured using the ArcGIS field calculator (hence only the direction between the beginning and end points of the digitized line were measurable - as opposed to producing a mean direction - although it is believed that in practice the error produced is minimal as the majority of boundary sections are generally straight). Ray diagrams were produced, plotting the total distance of boundaries in each direction within a range of 180º i.e. opposing directions, such as northwest and southeast, were equated. The directionality of the boundaries was unknown, so both possibilities were plotted in order to compare them with the identified aspect of the daleside.

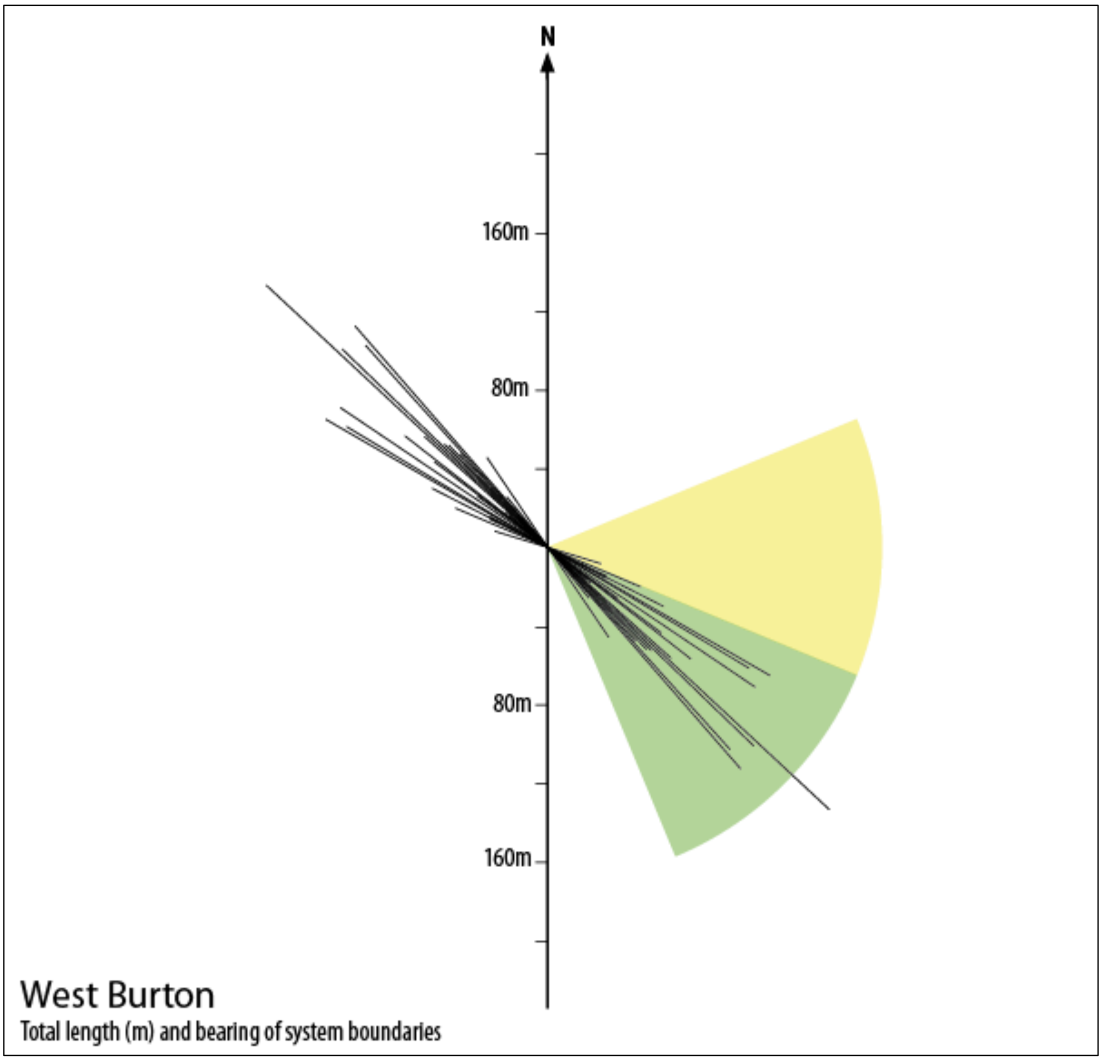


Fig. 5.29 The rays show the orientation of the boundaries (both SE and NW options are plotted for boundaries running SE-NW) and the coloured sections represent the primary and secondary aspect of the hillside.

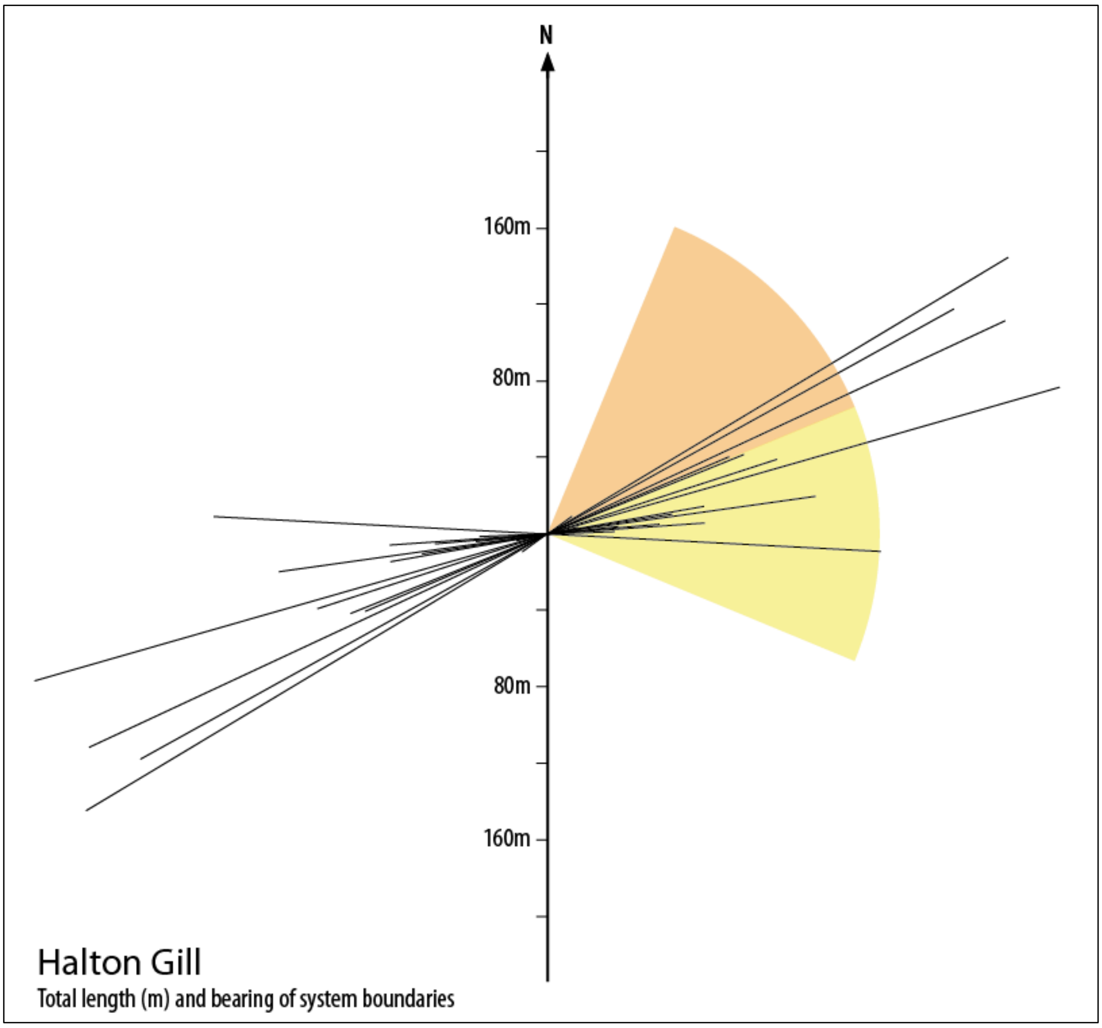


Fig. 5.30 Ray diagram indicating boundary orientation and hillside aspect for the Halton Gill system.

The majority of the resulting ray diagrams (see Appendix 3) show the boundary rays are closely aligned in one definite direction, indicating the coaxiality of the boundaries (figs. 5.29 - 5.30). Some systems, for example Kilnsey 1 and 2, Grassington-Kettlewell 2 (fig. 5.31) and 6, and Healaugh, show a smaller number of returning boundary rays at approximately right angles to the main orientation, representing subdivisions or terminal boundaries. Grassington-Kettlewell 6 shows a wider variation of direction, though the spread is still limited, again reflecting its slightly anomalous, reused, morphology as well as changes in aspect of the hillside across the system (fig. 5.32). Similarly, Carperby demonstrates a wider spread, which is thought to reflect the slight curvature of the hillside on which it sits. The Swaledale systems (which excluded the evidence of settlement for these purposes) demonstrate a high proportion of rays at right angles to the main orientation, indicating a high frequency of transverse and terminal boundaries; they also demonstrate a relatively wide spread of direction of both the axial and transverse rays, suggesting they are less precisely parallel than those of the southern dales (fig. 5.33)

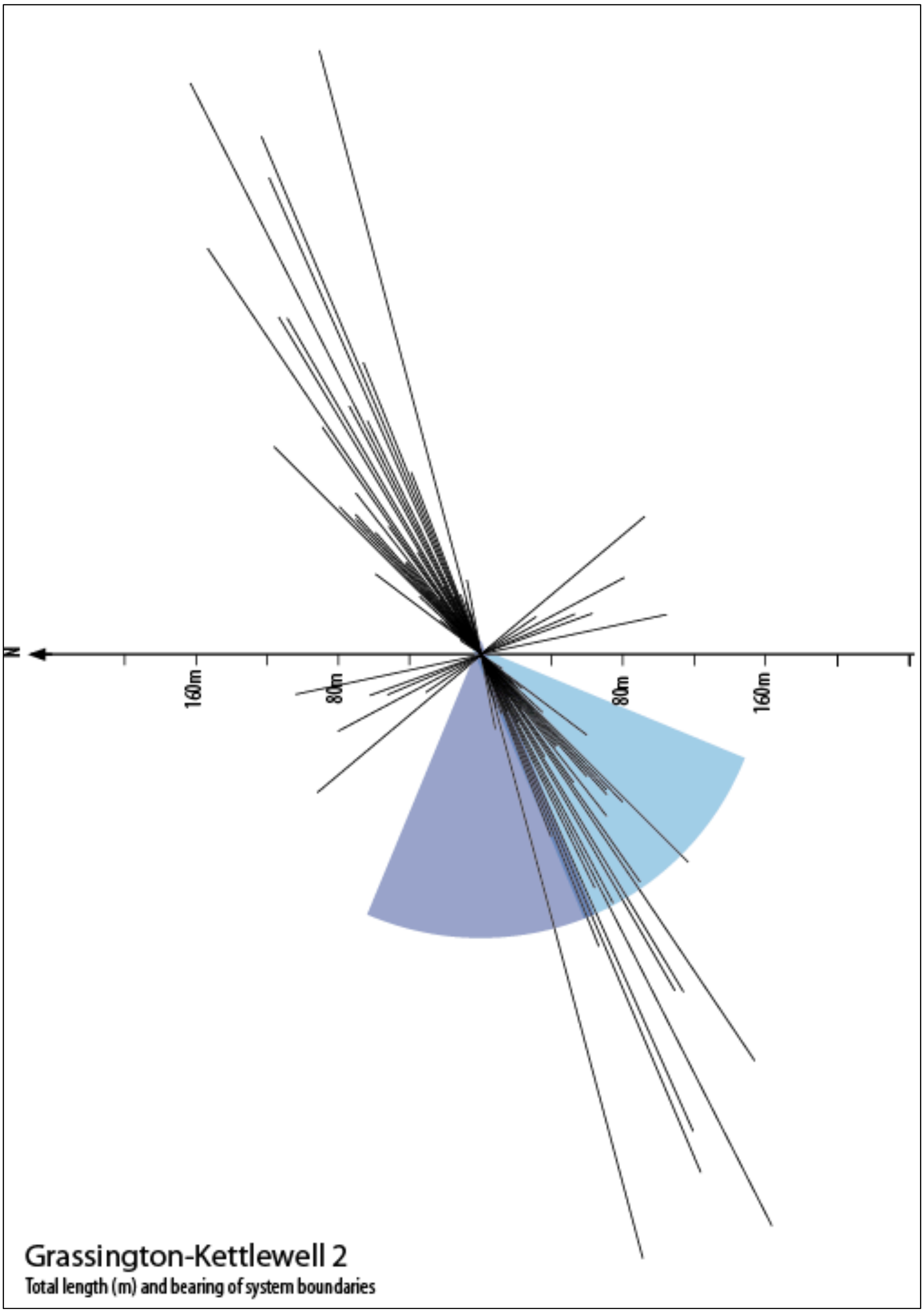


Fig. 5.31 Ray diagram indicating boundary orientation and hillside aspect for the Grassington Kettlewell 2 system.

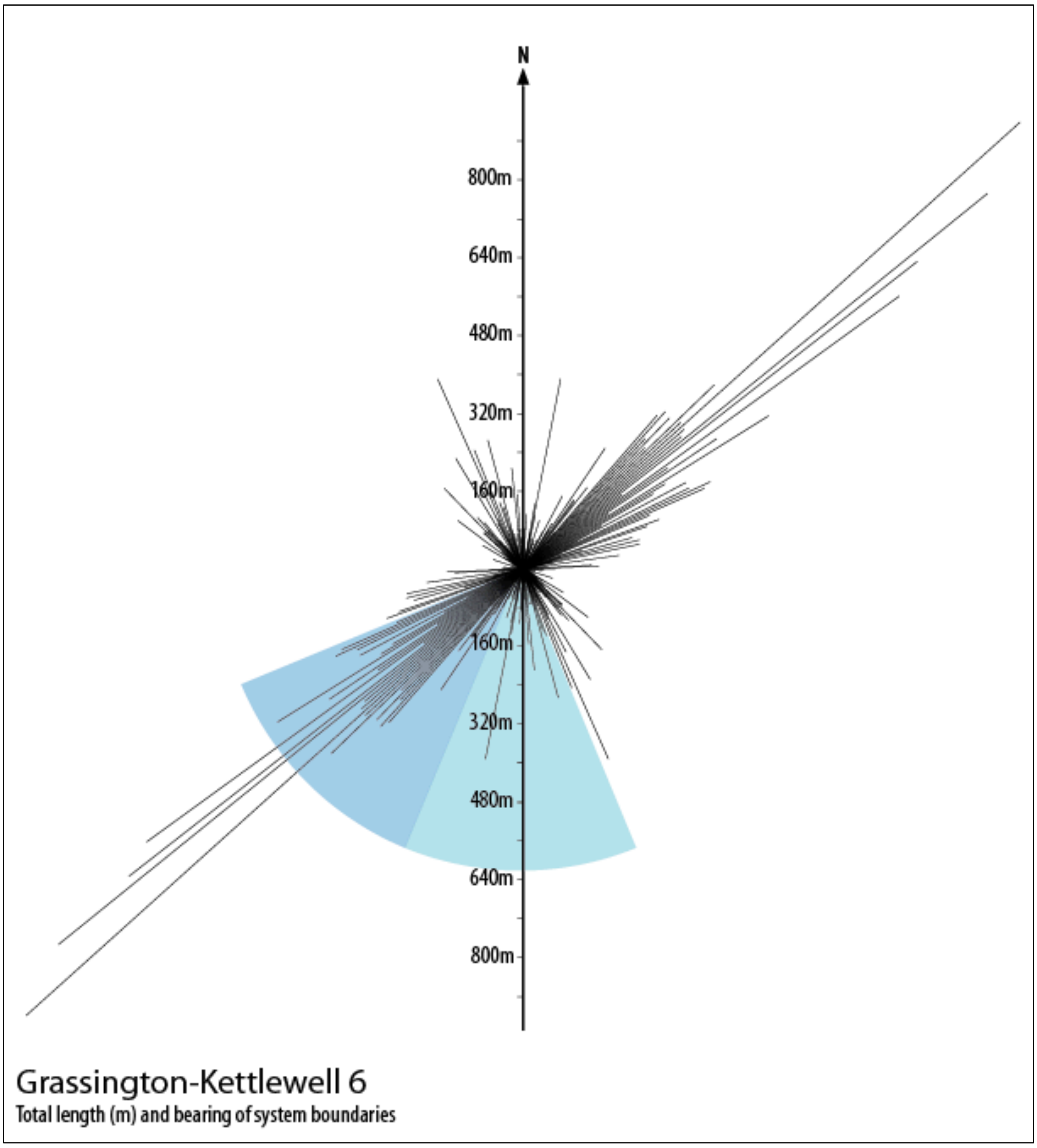


Fig. 5.32 Ray diagram indicating boundary orientation and hillside aspect for the Grassington-Kettlewell 6 system.

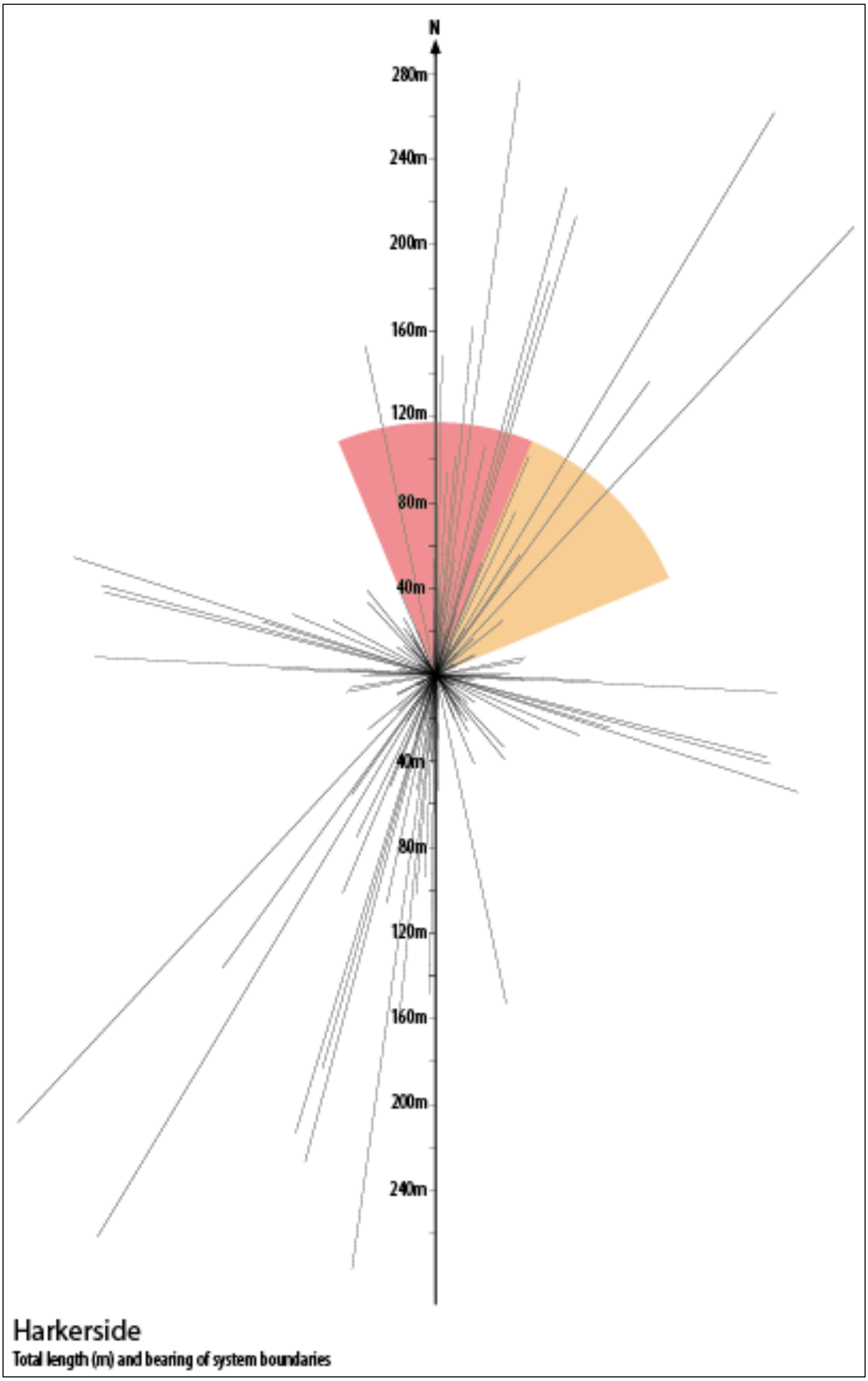


Fig. 5.33 Ray diagram indicating boundary orientation and hillside aspect for the Harkerside system.

The majority of the ray diagrams show the main orientation of the rays to correlate with the highlighted primary/secondary aspect of the hillside. In other words, they run up/down the hillside; it is apparent both on the ground and from the maps (see Chapter 4) that they cross the contour at right angles. The three exceptions (see Table 5.2) can in fact be taken as seeming to cross the contour on the ground: the aspect recorded for Carperby 1 (NW and W) reflects the slight gradient of one terraced plateau where the field system sits, within the greater terraced hillside, which, taken as a whole would correspond with the axial boundaries; the boundaries of Carperby 2, running NW-SE are slightly off the recorded aspect of W and S; while the land at Stainforth does slope down to the north and northwest, it also drops to the southwest and west through a series of limestone pavement terraces (fig. 4.81) against the contour of which the axial boundaries run. Roughly half of the systems are situated on land orientated south, southwest or west - although this could be assumed in theory to be the best agricultural land, the local topography complicates the situation.

Taking the modal direction for each system and plotting a further, combined, ray diagram around 180º, it is clear that there is a certain amount of spread around the compass. It seems that, on the whole, the boundaries are avoiding north-south orientation and, to a lesser extent, east-west. There is a slight bias towards the northeast-southwest direction, as well as the southeast-northwest sector. It is interesting to note that this reflects the alignment of the summer solstice sunrise/winter solstice sunset and winter solstice sunrise/summer solstice sunset respectively i.e. 40/220º and 130/310º. The spread of alignments around the exact important points of the solar arc may be plausibly explained by the variation in topography and relatively close horizon in the vicinity of each boundary system caused by the deep valleys and high interfluves.

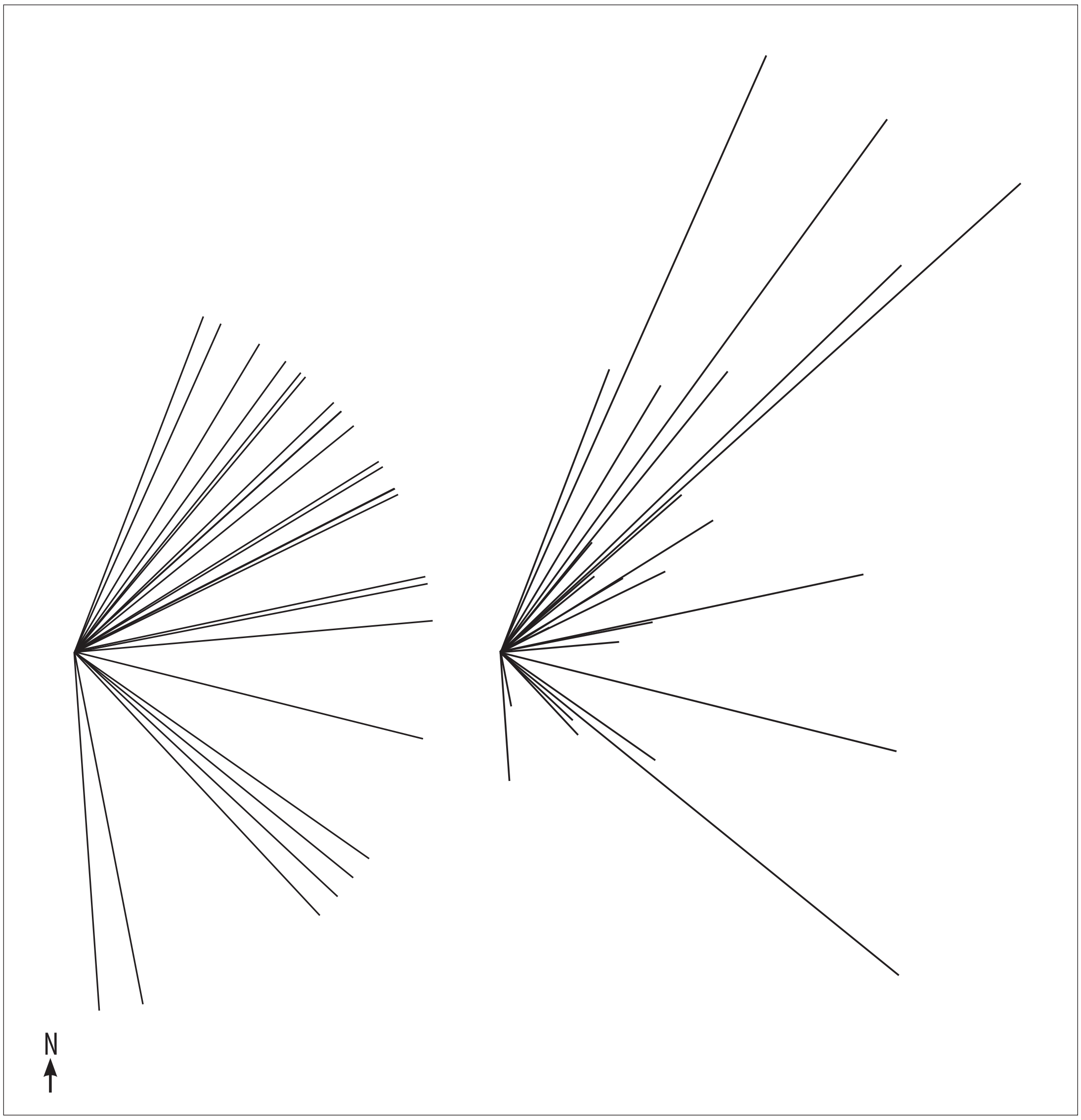


Fig. 5.34 Left: each ray represents the modal direction of one system. Right: each ray represents one system - the direction represents the modal direction and the length represents the total distance of boundaries aligned on that alignment within the system (distances are relative).

5.4.3 Elevation

Finding the systems on the ground emphasizes their elevation and in many cases the gradient. All the systems are higher than 150m aOD and some extend above 400m aOD. Beyond this altitude the land is mainly moorland, covering the watersheds. The land below this drops significantly to flat valley floors, which have been more intensively used more recently. The graph in fig. 5.35 indicates clearly that the coaxials are located roughly halfway up the valley sides, dividing the zones of the valley. This can also be extrapolated and plotted as a zone between 260m and 465m (the interquartile range of the systems' extents) on a map of the national park, which serves to emphasize further the division of the valleys into three zones by the field systems.

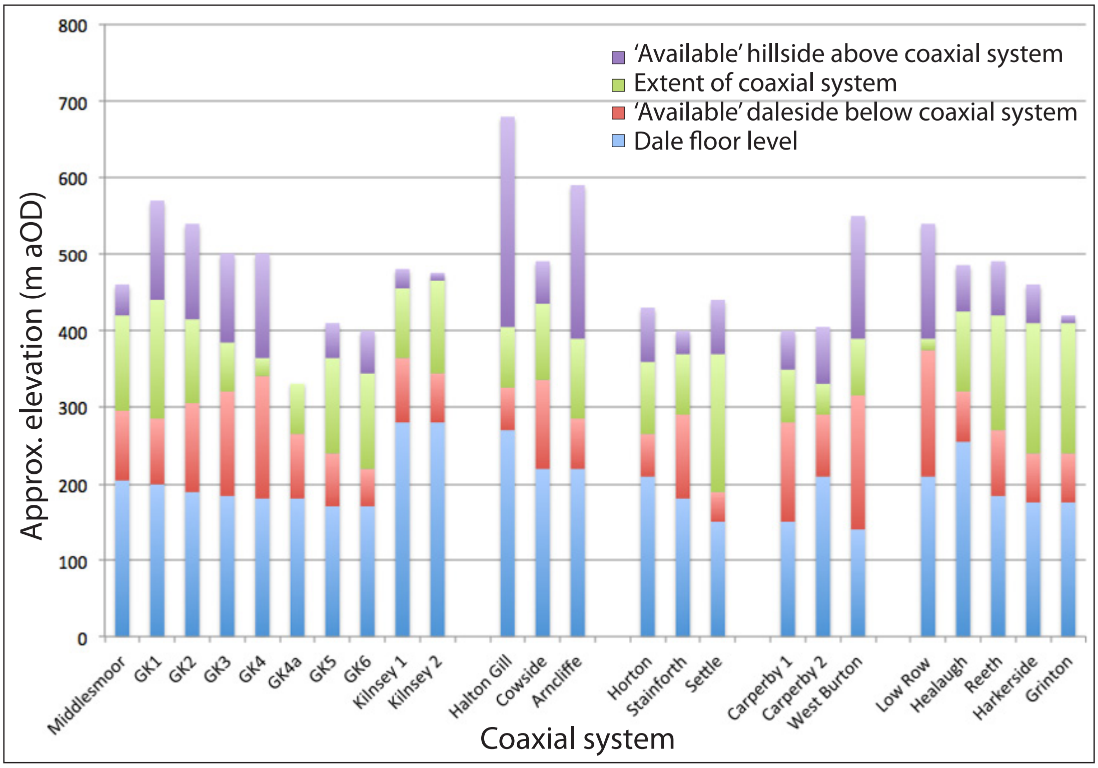


Fig. 5.35 Elevation of coaxial systems relative to the topography of the valley side. The top of the blue bar represents the height of the dale floor above sea level; the green bar represents the elevation spread of the coaxial system; the red and purple bars represent the daleside and fell 'available' for exploitation by the systems.

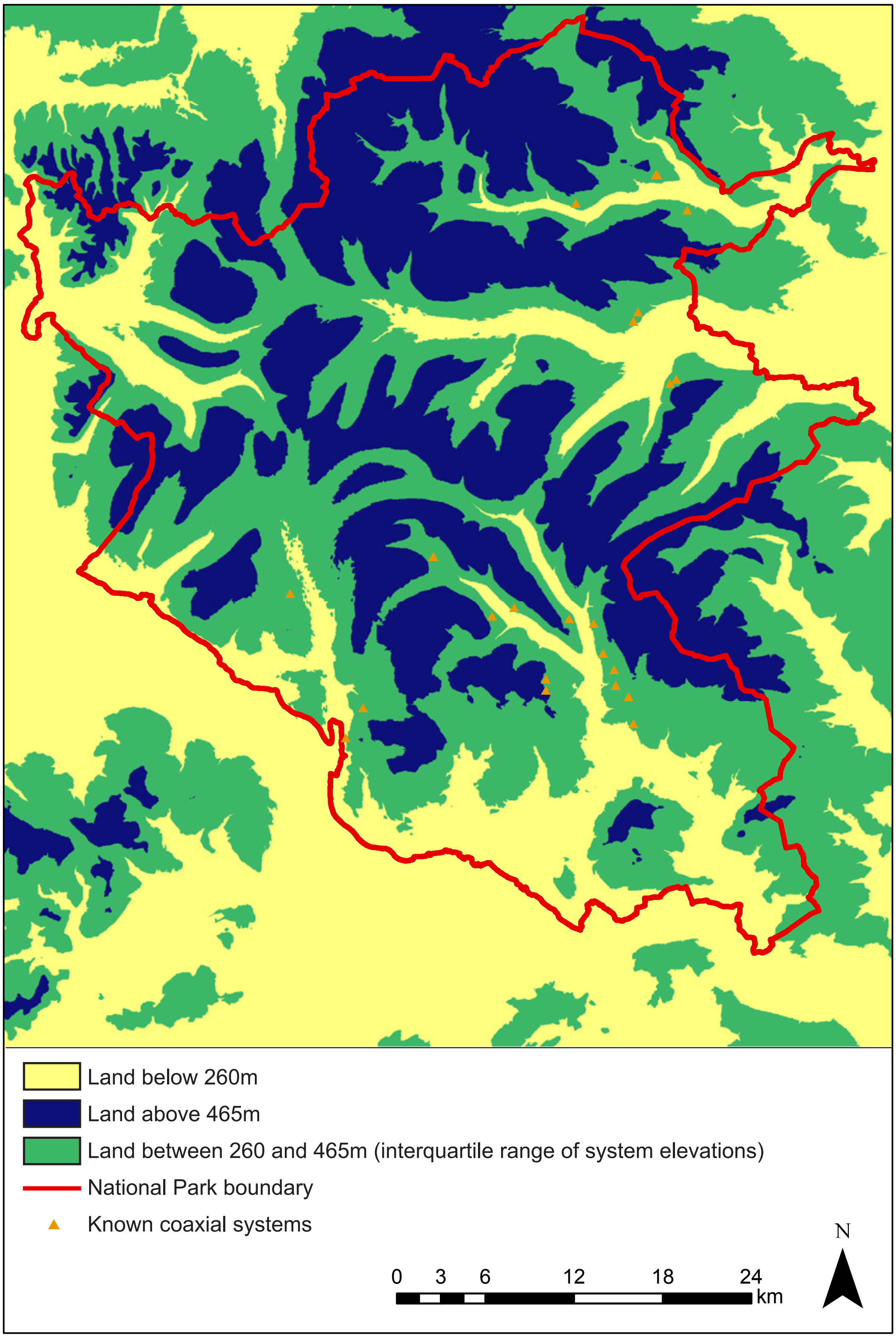


Fig. 5.36 Known coaxial systems, located on the 'middle third' of the valley sides. (Derived from OS Terrain-5 contour data.)

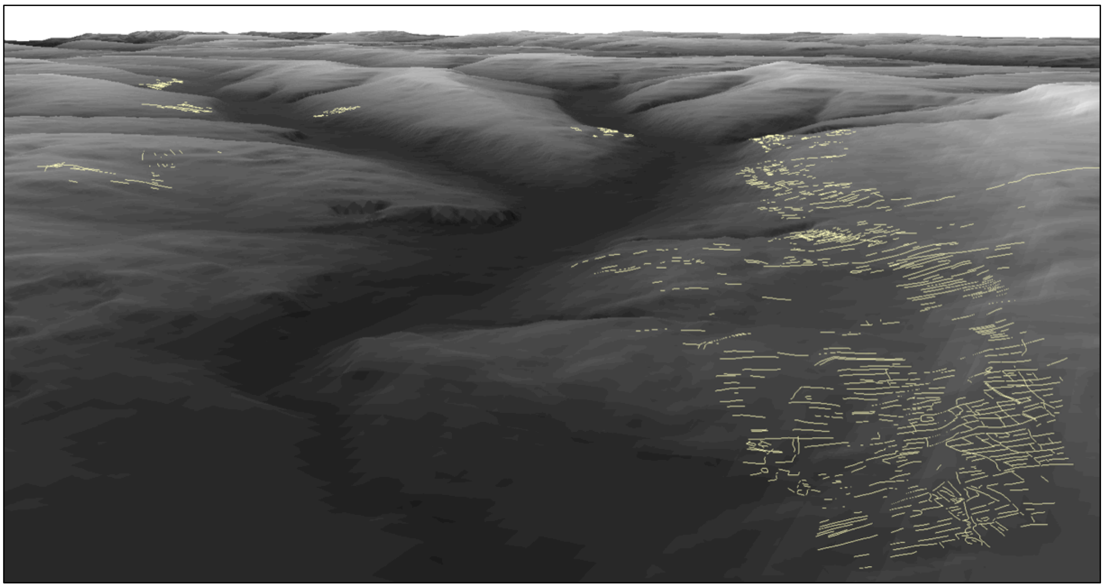


Fig. 5.37 'View' northwest up Wharfedale and Littondale demonstrating the situation of the field systems above the valley floors. Coaxial boundaries marked in yellow. (Generated from OS Terrain-5 contour data in ArcScene.)

The elevation is such that, when standing on the ground within a system, the overwhelming sense is one of space, with an awareness of being above the valley floor rather then enclosed by the valley sides, as figs. 5.38 - 5.39 attempt to demonstrate. It is often the case, given the widespread presence of terraced valley sides, that one cannot see down into the main valley immediately below a given system (figs. 5.40 - 5.41). If, as Section 5.4.2 suggests, the orientation of the boundaries was important, it is noticeable that the horizon is much more 'open' from the elevation of the systems than it is from a position in the bottom of the narrow valleys, and this has an impact on the possibilities of aligning features on topography or the local positions of sun rise/set.

Fig. 5.38 View northwest looking up Wharfedale from Middlesmoor Pasture coaxial system (approx. 350m aOD).

Fig. 5.39 View southwest looking over Bishopdale from West Burton coaxial system (approx. 350m aOD).

Fig. 5.40 View northwest looking towards upper Littondale from Arncliffe coaxial system (approx. 360m aOD). Despite the elevation, the terracing obscures views of Littondale below.

Fig. 5.41 View southwest looking towards mid Swaledale from Reeth coaxial system (approx. 300m aOD). Despite the elevation, the terracing obscures views of Swaledale and the mouth of Arkengarthdale immediately below.

5.5 Settlement and resources

5.5.1 Cairns

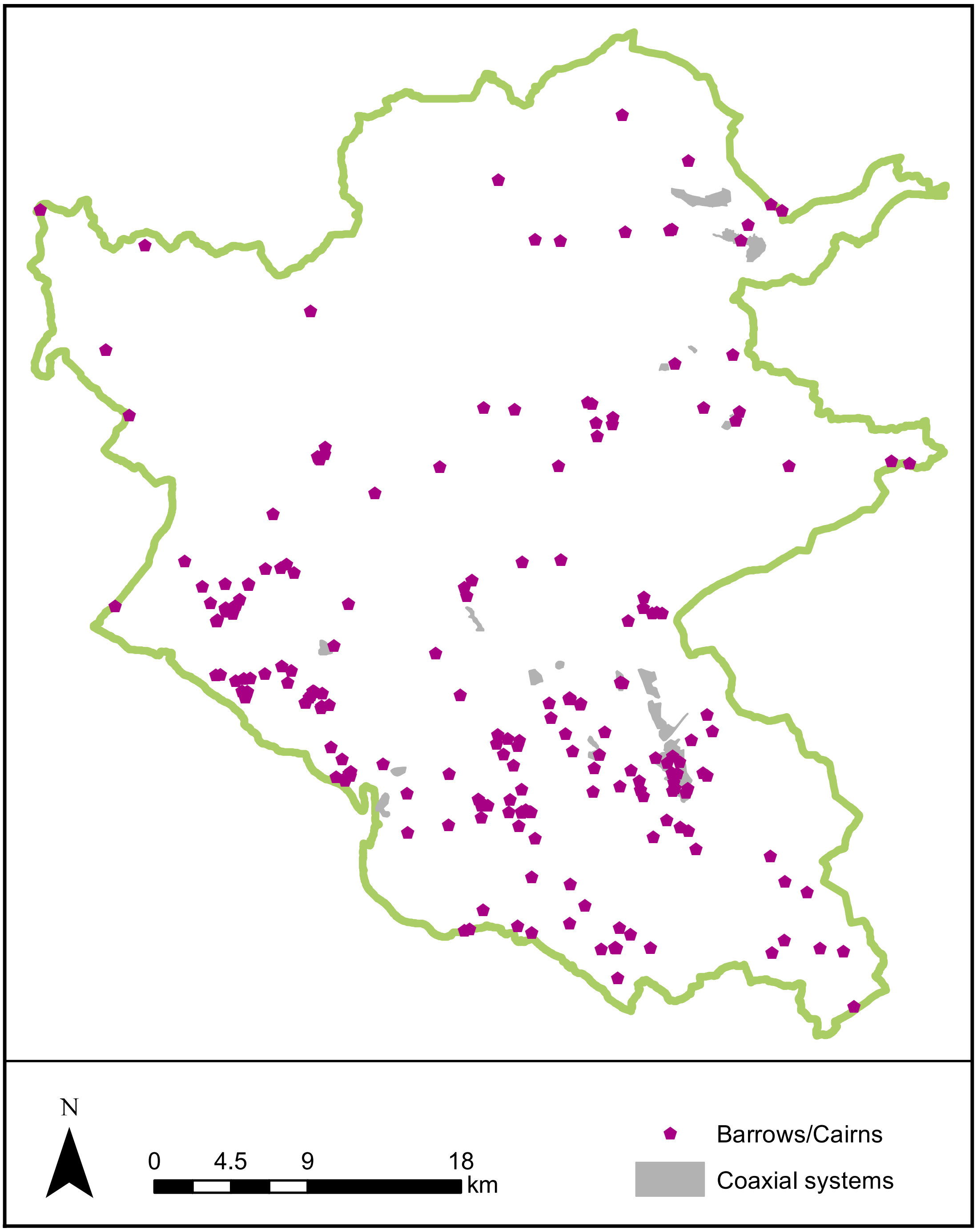


Fig. 5.42 Distribution of prehistoric known and possible barrows and burial cairns in the Yorkshire Dales National Park in relation to known coaxial field systems (Data source: HER).

According to the HER database, 219 known and possible barrows and burial cairns are distributed through the National Park, as recorded in fig. 5.42. At least one barrow/cairn is located within the interior of each of 11 of the 24 systems, with 11 barrows/cairns within or immediately adjacent to the combined systems of Grassington-Kettlewell 4, 4a, 5 and 6 (figs. 5.43 - 5.44). Among these latter 11, three (MYD4381, MYD53348 and MYD41853) are recorded as possible cairns, recently identified either through ground survey or examination of aerial imagery. MYD4051 is described in the HER as a "large, unmutilated cairn… [with an] average height of 2.5m… constructed of earth and limestone fragments", however, it is noted that its "situation in a valley and polygonal shape are not typical of known Bronze Age cairns in the area". The remaining seven cairns (summarized in Table 5.3) were excavated in the late-nineteenth or twentieth centuries, and all found to contain burials in varying numbers and associated artefacts.

Table 5.3 Summary of HER information relating to Bronze and Iron Age burial cairns in figs. 5.43 and 5.44. (Data source: HER)

HER ID Number and date of excavation	Dimensions	Construction	Burials	Finds
MYD54027 1893	19m diameter	Boulders, gravel & clay	Central rectangular grave with crouched skeleton	Iron knife with deer horn handle; worked bone.
			2nd grave south of centre with fragments of bone	Jet button
			3rd burial east of centre	
			Partial skeletons to SE and NNW of centre.	
				Bronze ring and animal bones in gravel fill.
MYD4031	12m diameter	Internal circular	Crouched burial	Bone awl

1893		walls with diameter of 5m and 12m diameter on low hillock	at the centre	
			2nd burial SE of centre	Bronze ring
			3rd burial E of centre	
			4th burial N of centre	
MYD4033	0.6m high	Earth covered mutilated cairn on summit of limestone outcrop	Crouched burial	2 iron knives
MYD4032 1893	23m diameter	Turf covered, loosely packed limestone, on commanding ridge	7 burials	4 iron knives, bronze pin, bronze razor and bone pin.
MYD4366 1892	23m diameter, 1.7m high	Composed of limestone boulders internal divisions into chambers, built on highest point of the "Roman Camp"	1 cremation, 1 crouched inhumation, 2 other inhumations	1 all-over cord type beaker
MYD14996 1892-3	1.7m high	Double ring of loosely piled stones	Multiple burials towards periphery, including crouched skeletons	
MYD4025 1892-3	19m diameter, 1m high		Crouched burial and other interments	Iron knife and other objects, sherds of chevron marked

	pottery, bone comb, pin and handle, jet button or pendant, bronze ring, flint scraper

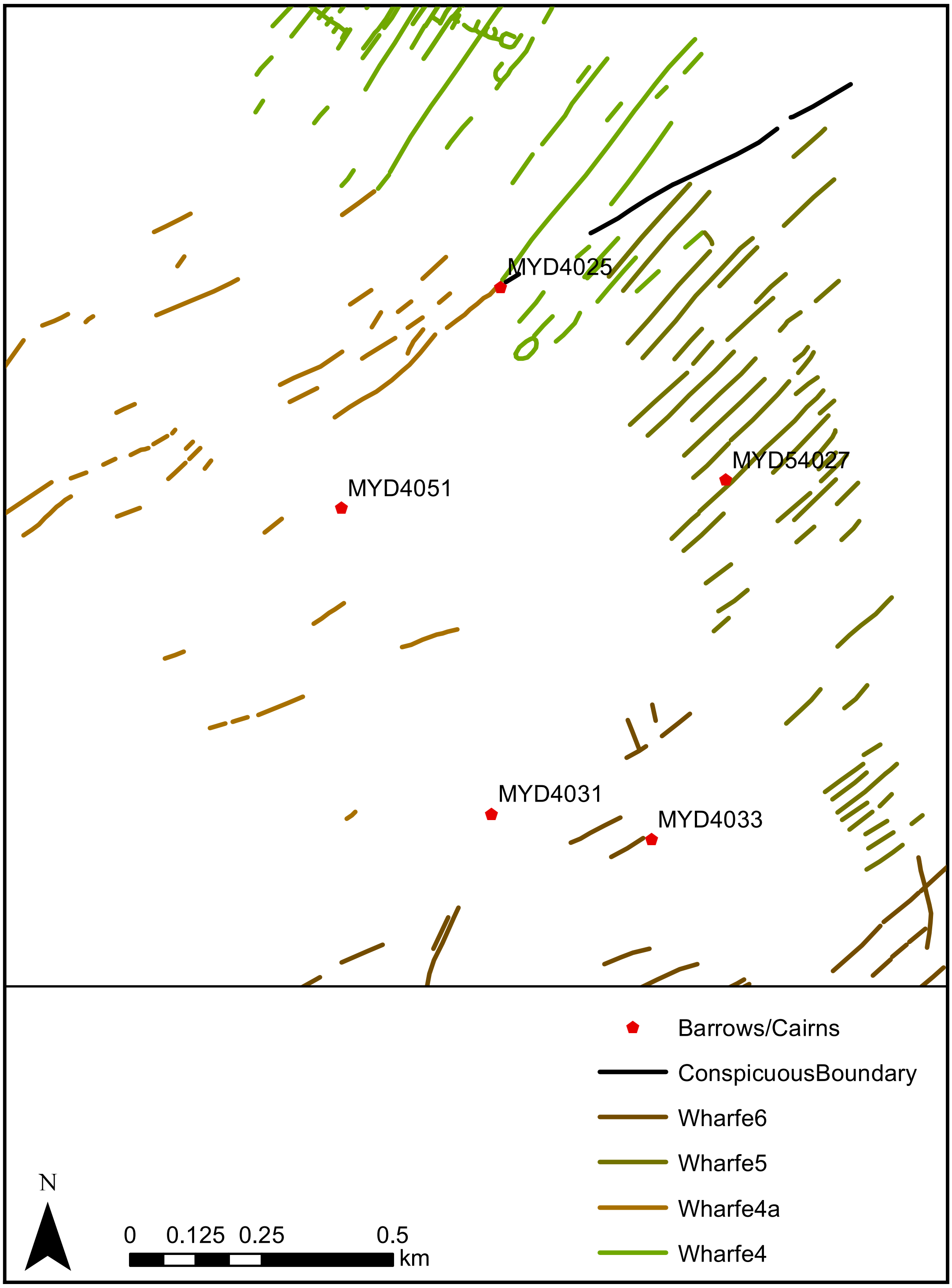


Fig. 5.43 Prehistoric barrows and burial cairns in relation to the boundaries of Grassington-Kettlewell coaxial field systems (North) (Data source: HER).

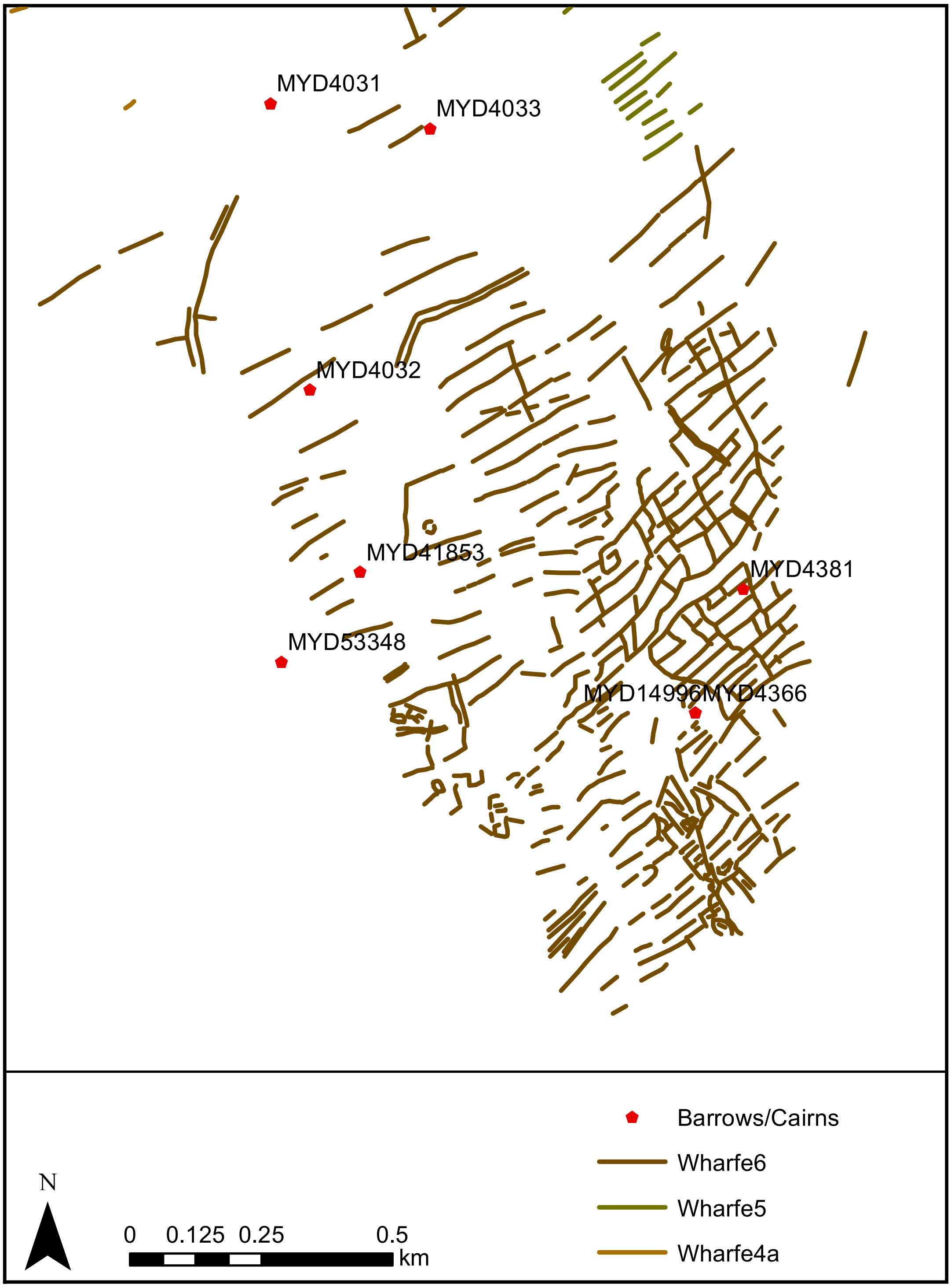


Fig. 5.44 Prehistoric barrows and burial cairns in relation to the boundaries of Grassington-Kettlewell coaxial field systems (South). (Data source: HER).

While these features, generally considered to date originally to the early-mid Bronze Age, can be assumed to have been in existence prior to the building of the field systems, their presumed long life and later direct reuse suggests that they retained significance of some sort during the lifetime of the later prehistoric coaxial systems. Having said that, only one (MYD4025) (fig. 5.45) can be demonstrated to have a direct relationship with the boundaries themselves. This cairn, approximately 19m in diameter and 1m high, with a rudimentary surrounding kerb, was excavated by E. E. Speight and the Upper Wharfedale Exploration Committee in 1892-3 (Speight 1894). It was reported that, on the whole, human remains were fragmentary, but, on a related note, rat remains were frequent. In the central portion of the cairn a crouched burial was uncovered, with a third thigh bone indicating a double interment, with an iron knife, part of an iron pin or nail and a piece of worked bone with an iron rivet; from south of the centre, a flint scraper was recovered, along with animal bones, charcoal, 30 human teeth, a doubly perforated jet button/pendant, sherds of chevron-marked pottery, part of a bone pin and a bone handle, while a nearby shallow hollow contained 'a few' human teeth; to the east of the centre, a bronze ring (possibly part of a brooch) was found, as were remains of another interment with an iron nail; in the southeast portion of the cairn were found pieces of skull and several phalanges; to the north-northwest, similar skeleton fragments (Speight 1894: 376-77). The cairn appears to be the focal point for a boundary running upslope as part of the Grassington-Kettlewell 4a system and one running downslope as part of the Grassington-Kettlewell 4 system, as well as for a conspicuous boundary composed of medium-large boulders that runs at an angle to both these systems and the adjacent Grassington-Kettlewell 5, appearing not to belong to any of them (see Horne & MacLeod 1995: 38-39) (fig. 5.46). Although it is easy to assume that this boundary was contemporary with the later prehistoric field systems, it may well have been considerably later or, given the large boulders of which it is comprised and total robbing of any smaller material, earlier. The relatively even spacing of the boulders and apparent lack of smaller rubble filling mark it out as different from the coaxial boundaries, and suggest it may have had wooden hurdles or similar placed between the stones; the possibility also exists that it represents a marker, sufficient on its own to create a boundary without requiring a full physical barrier, or that it was intended to remain permeable in some circumstances, for example marking a change in control of land but still allowing animals to be driven through it.

Large cairns, probable prehistoric in origin, are also recorded in or very close to the Stainforth coaxial system (MYD1540), the Low Row system (MYD58742) and on the top of Dove Scar (West Burton system) (MYD57735).

Fig. 5.45 Burial cairn MYD4025, Wharfedale, (centre frame). In the foreground are stones belonging to an axial boundary of the Grassington-Kettlewell 4a system; in the backrougnd, boulders forming a conspicuous boundary that does not appear to belong to either of the surrounding systems. The boundaries of Grassington-Kettlewell 4 (behind the cairn) are not visible in this picture. Photo: author.

Fig. 5.46 Conspicuous boundary that does not appear to belong to system GK 4 or 5. Photo: author.

Arguably part of the same spectrum of features as large burial cairns, several of the systems contain numerous smaller cairns, such as that in fig. 5.47 at Horton, which are usually categorised as clearance cairns, although they may also contain burial remains of various descriptions (Johnston 2001). Having been surveyed at closer quarters than some of the other systems, those on Harkerside and Calverside (Swaledale) are known to contain extensive cairnfields, presumed to be associated with early cultivation of the area (Laurie et al. 2011). The possibility of clearance cairns within the

Grassington-Kettlewell systems has also been raised by the High Close Project (Martlew 2011: 65, fig. 7.4).

Fig. 5.47 One of a cluster of small cairns, probably related to clearance activities, located within the coaxial system at Horton (not yet recorded on the HER). Photo: author.

5.5.2 Settlement

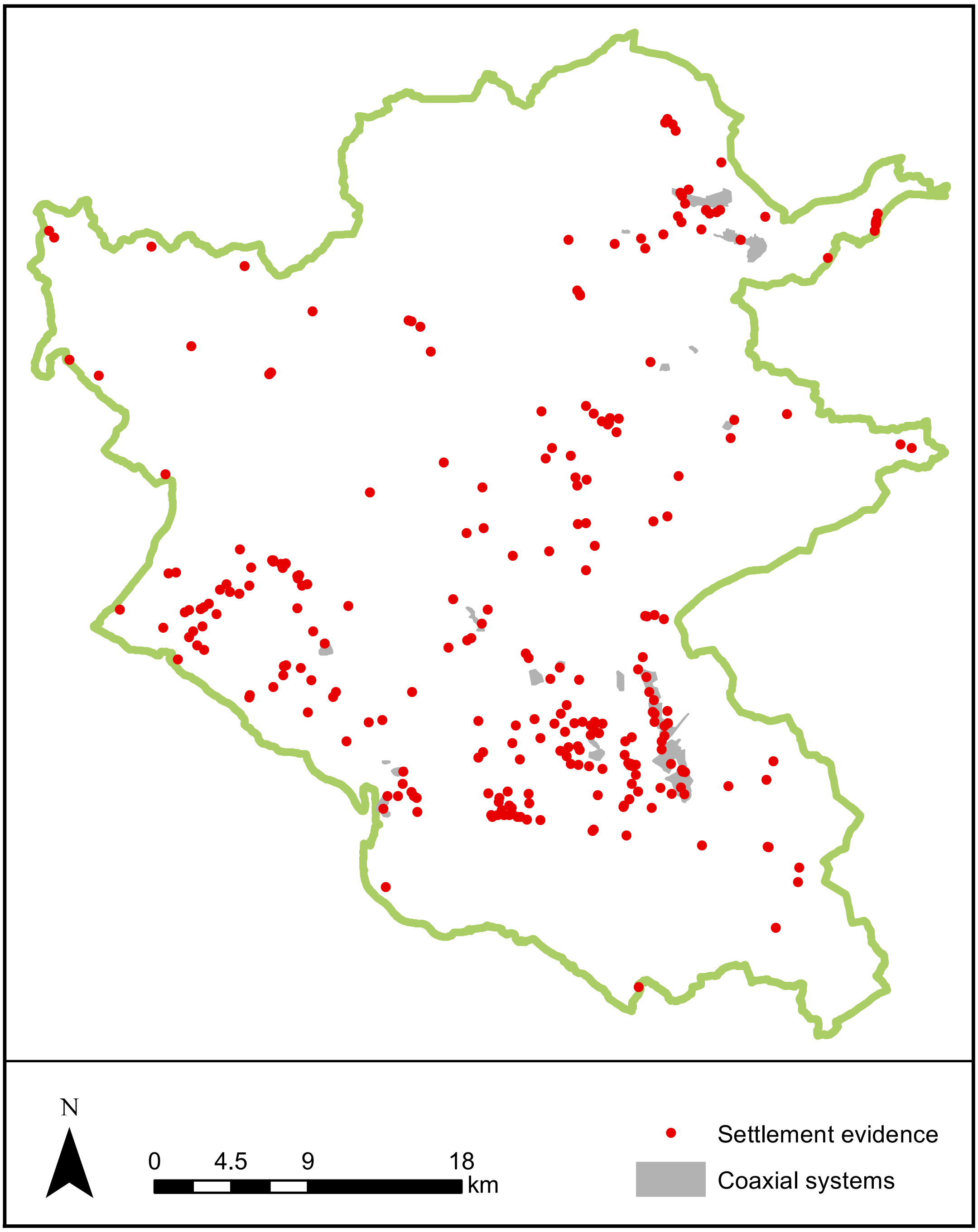


Fig. 5.48 Distribution of prehistoric settlement evidence in the Yorkshire Dales National Park in relation to known coaxial field systems (Data source: HER).

The settlement remains of the Yorkshire Dales have not been investigated sufficiently closely, particularly with regard to obtaining dates, to allow conclusions to be drawn regarding their proximity or relationship to the coaxial systems. Few stone buildings, and fewer still of those of which only post holes and slots remain, have been excavated or surveyed, while most of the stone building remains visible on the surface lack any chronologically distinguishing features to differentiate between prehistoric and later structures. The majority of those identified in fig. 5.48, have been done so on the grounds that they conform to the generally identified local pattern of Iron Age and Romano-British settlement (which includes building platforms, small boulder/rubble enclosures against the scar, and enclosures with wall passages), although work such as that at Healaugh, Swaledale (Fleming 2010: 155-6), and Chapel House Wood, Wharfedale (Martlew 2011: 67-68), is suggesting that this categorization may be somewhat meaningless as new forms are being revealed. Equally, spatial proximity to the field systems does not necessarily reflect temporal proximity. It is apparent, however, that there are no distinct, overtly prehistoric settlements within the coaxial systems - this may be, as concluded at High Park, that the settlement was intentionally located in another part of the landscape (Jecock 1998: 31), or that wooden remains have yet to be recognised in the Yorkshire Dales. Moreover, seasonal occupation is a posibility that may leave less visible remains.

5.5.3 Civil Parish Boundaries

There is no apparent correlation between later civil parish boundaries and late prehistoric systems or their boundaries. Assumptions that the Saxon land units that evolved into civil parishes were themselves based on ancient land parcels have been challenged with map regression suggesting civil parish boundaries were ‘imposed’ on and across the earlier land patterns (see Williamson 1986). The coaxial systems in the Dales do not correspond in any obvious way to the later boundaries; there are several examples, such as Grassington-Kettlewell System 5, where the civil parish boundary cuts across the coaxial parcel at a different angle.

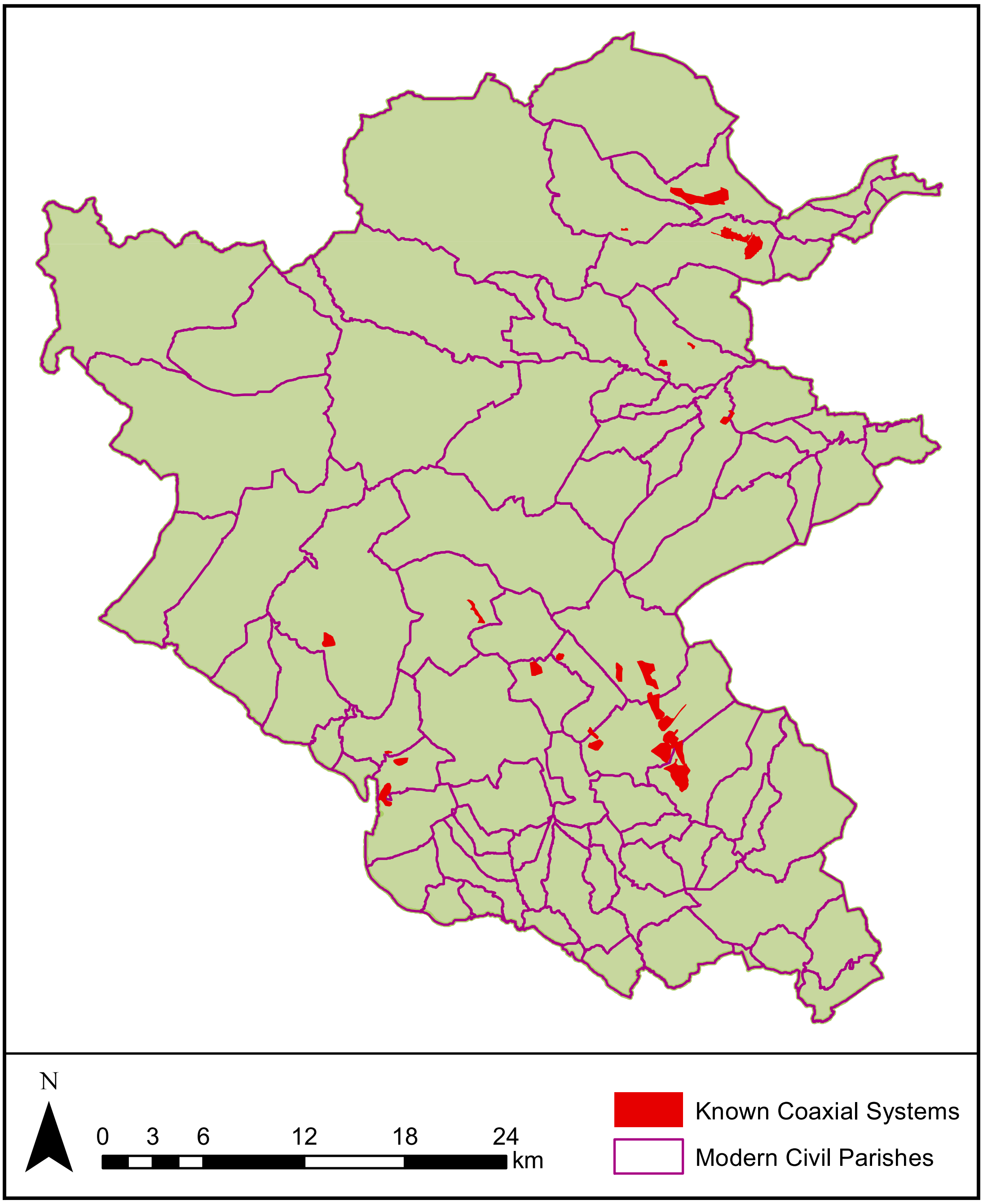


Fig. 5.49 Distribution of known coaxial systems in relation to current civil parish boundaries in the Yorkshire Dales National Park (Data source: HER).

5.5.4 Water supply

The majority of systems, lying as they do on various limestone beds, are well drained and contain few, if any, water sources (figs. 5.50 - 5.52). Most have springs or streams in the general vicinity, although this typically involves significant, often steep, changes in elevation to reach them and in any case they are regularly dry as water finds alternative routes through the limestone.

There is no surface evidence for water storage pits or channels apparent among the ranker grasses, heather and limestone scree, although such things may exist cut into the bedrock. Water would have been available to some field systems from higher ground before it permeated into the limestone, as well as available from springs below the limestone. Either situation suggests that some sort of water management would have been required. This goes some way towards suggesting that the enclosures were more suited to sheep, which glean much of their daily water requirements from grass, rather than cattle, which require more direct water consumption. The availability of a clean water supply may also have influenced the location of settlement relative to the coaxial systems. The general location of the coaxials in the mid part of the valleys (see fig. 4.16) may indicate the need to situate the field systems where the river and its associated resources are well-established enough to provide for the needs of a community (of people or animals): the limestone geology is such that many of the Dales rivers are prone to becoming dry on the surface for periods of time in the summer in their upper reaches.

Fig. 5.52 illustrates the relative frequency with which water courses occur across the coaxial systems in mid-Swaledale. It is noticeable that in places these appear to coincide with the, allbeit somewhat artificial, postulated boundaries of the systems to a greater degree than occurs in the more southerly limestone areas, perhaps due to the greater reliability and permanence of the water sources on the less permeable geology.

Although the data in figs. 5.53 and 5.54 relates to modern rainfall data (in the form of observed totals from 1961-1990), it seems reasonable to assume that, even allowing for climatic variation, the relative distribution will remain roughly constant, assuming prevailing wind direction did not vary greatly. The Pennine peaks cause the highest rainfall to occur within the western central portion of the National Park, with levels decreasing towards the east and the drier Vale of York. The known coaxial systems, and the majority of the 'possible' systems, are largely located in the rain shadow to the east and southeast of the wettest areas, which receives roughly 45-59% of the maximum rainfall in the National Park. On the other hand, as mentioned in Section 4.2 (fig. 4.10), the dearth of prehistoric finds in general in the northwest quadrant of the National Park also tallies with the rainfall data: this may be a reflection that the wettest areas are the most remote and see least modern activity and archaeological discovery, however, they may have seen least prehistoric activity for the same reason.

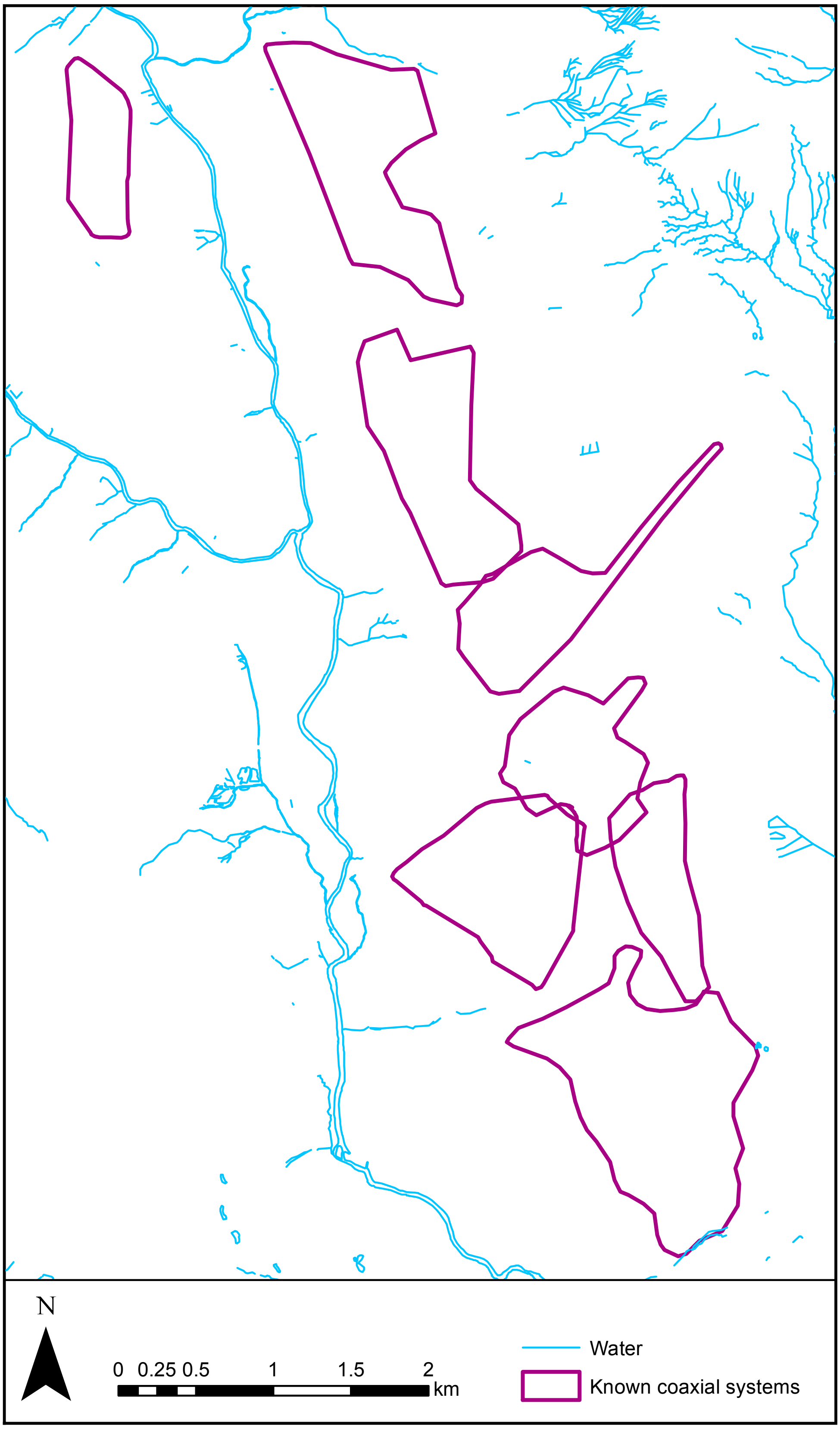


Fig. 5.50 Distribution of (modern) natural water sources in relation to known coaxial systems in mid-upper Wharfedale.

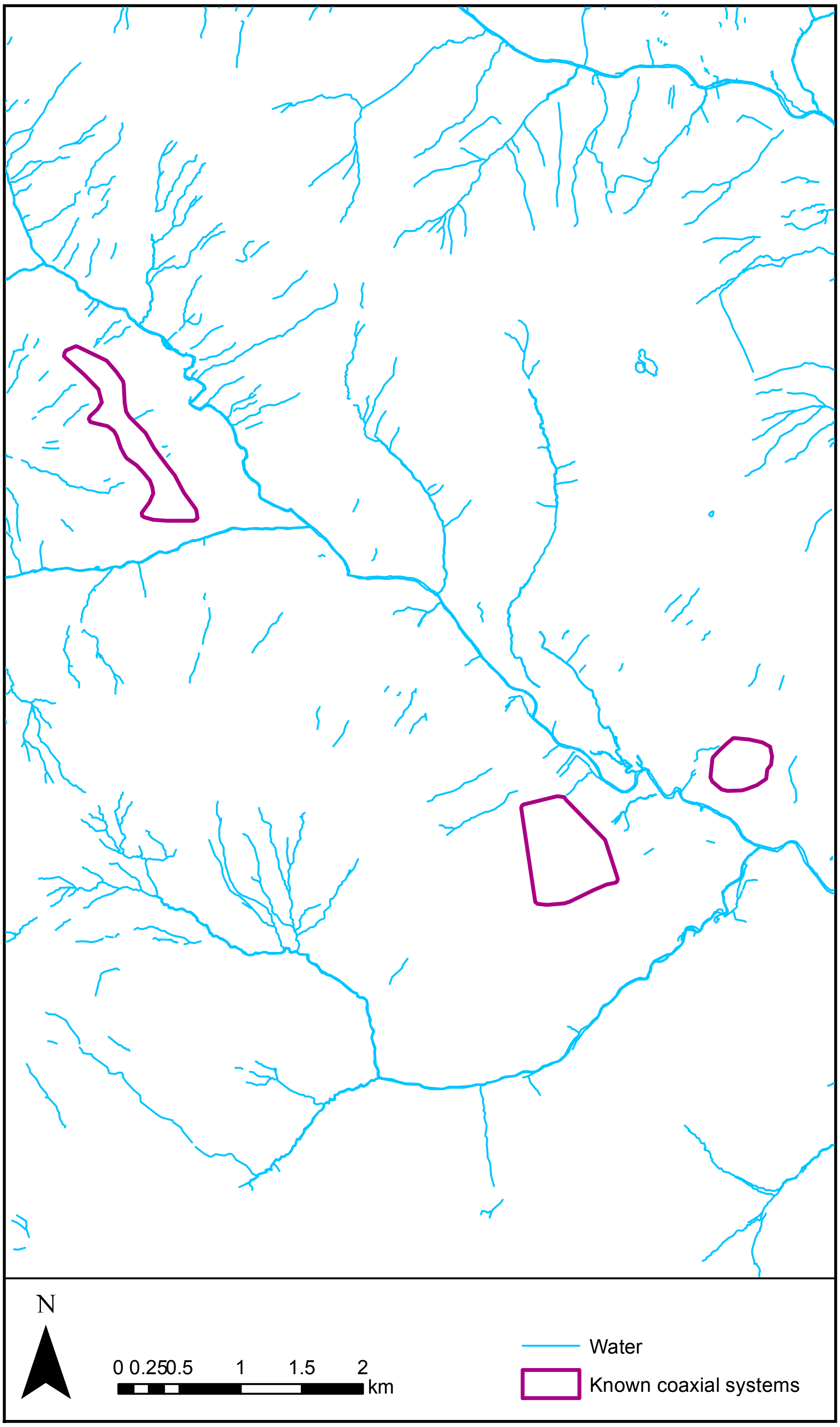


Fig. 5.51 Distribution of (modern) natural water sources in relation to known coaxial systems in Littondale.

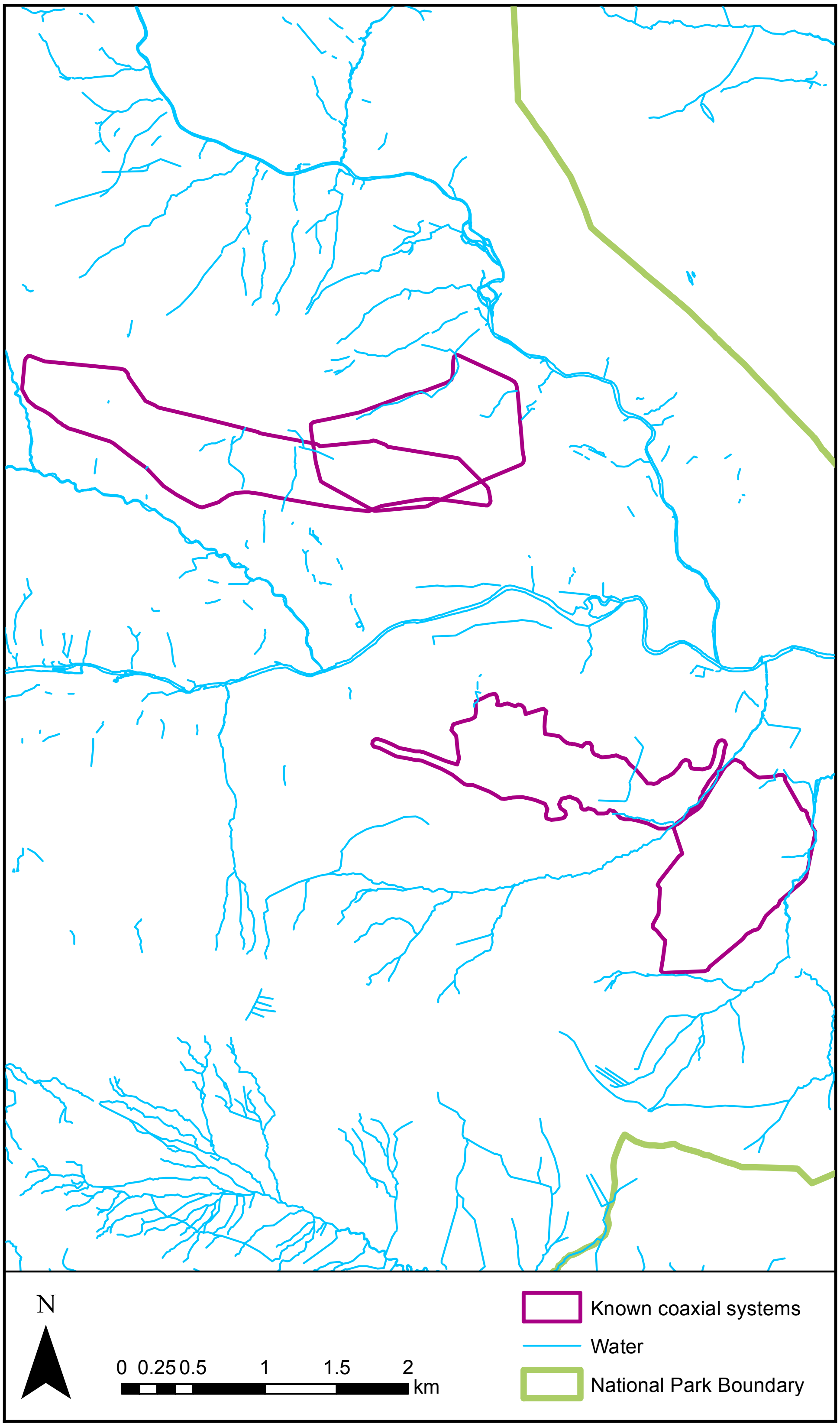


Fig. 5.52 Distribution of (modern) natural water sources in relation to known coaxial systems in mid-Swaledale. Note the greater availability of surface water, including watercourses apparently marking the extents of coaxial systems.

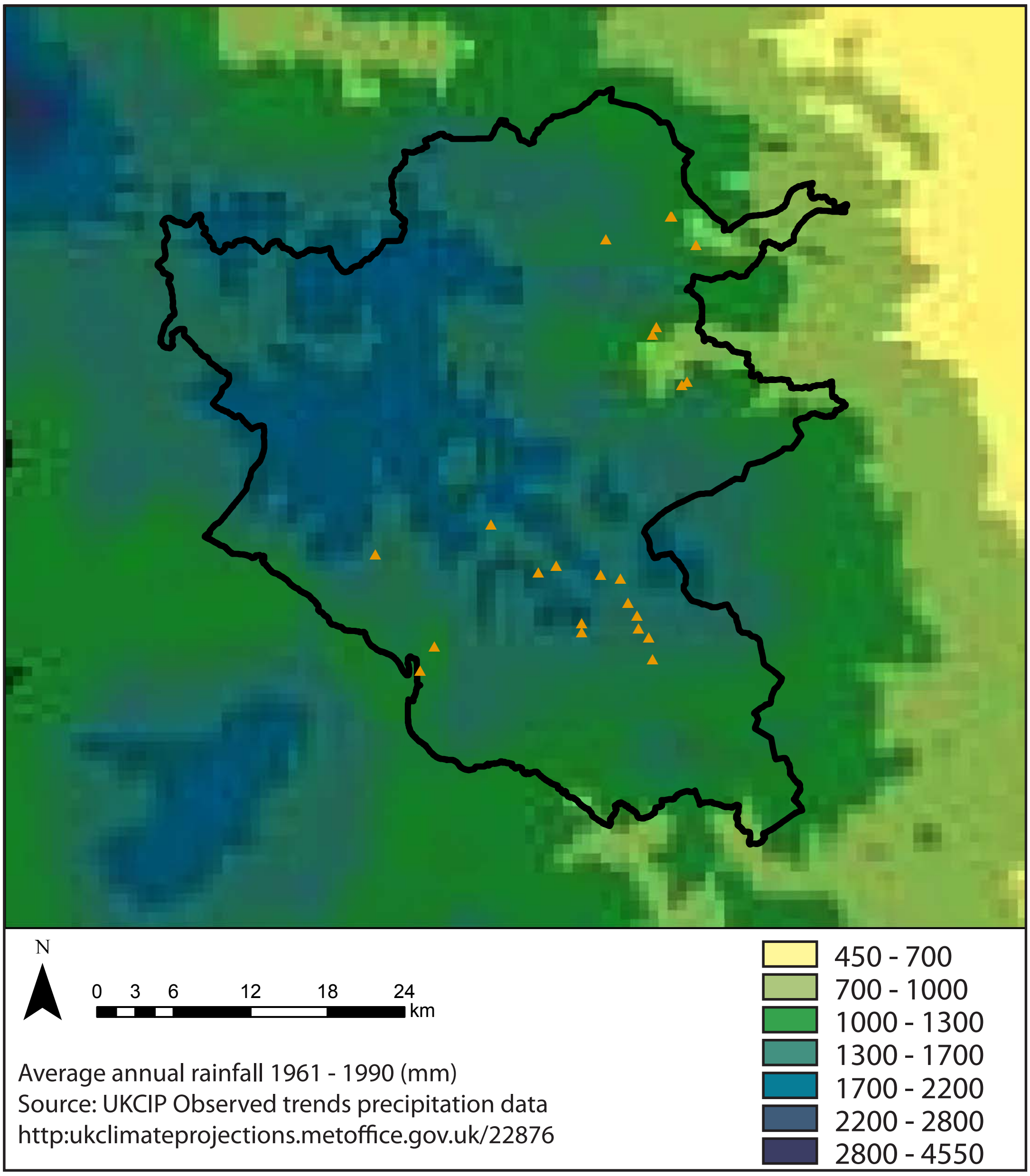


Fig. 5.53 Known coaxial systems in relation to average annual rainfall intensity. (Data source: UKCIP observed trends precipitation data http:ukclimateprojectionsmetoffice.gov.uk/22876.)

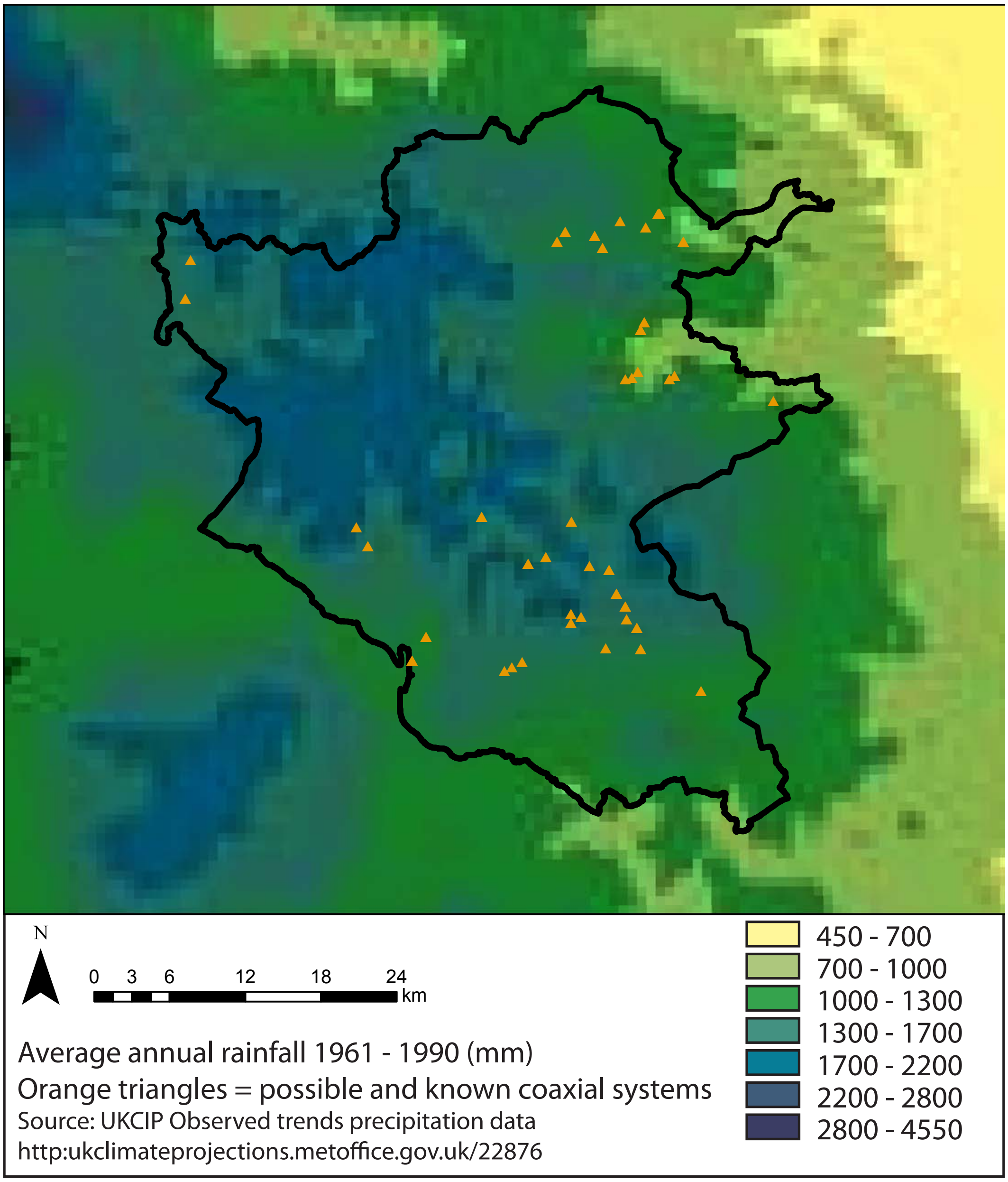


Fig. 5.54 Known and possible coaxial systems in relation to average annual rainfall intensity. (Data source: UKCIP observed trends precipitation data http:ukclimateprojectionsmetoffice.gov.uk/22876.)

5.5.5 Insolation

A variety of factors, including distribution of topographic features, elevation and orientation, as well as the time of day and year, affect the level of in coming solar radiation, which in turn directly or indirectly influences aspects such as air and soil temperatures, evapotranspiration rates, snow melt rates, soil moisture levels and levels of light available for photosysnthesis. In this sense, insolation can be plotted as a proxy for 'good' pastoral land. The most striking thing about the insolation plots (figs. 5.56 - 5.59), which represent the amount of solar energy incident on the ground over a given period of time (i.e. in kilowatt hours), is how faithfully they echo the topographic maps, with the open uplands receiving considerably more sunlight than the deep and narrow valley bottoms. (These plots do not, however, take day to day weather conditions into account; to judge from the rainfall data, the western portion of the national park would see reduced levels of insolation due to increased levels of cloud cover.)

Due to their elevation, the coaxial systems are generally situated on land with high to maximum insolation for this region during the summer months, and, because of their altitude and aspect, many are also relatively well illuminated during the winter months so that snow melts relatively quickly. A notable number of systems - including Middlesmoor Pasture, the Ribblesdale systems, West Burton, Kilnsey 2 and several of the Swaledale systems - sit lower down the scale of insolation calculated over the winter months, but nevertheless experience higher levels of light than the deeper valleys.

Fig. 5.55 View of upper Wharfedale, with the southwestern side of the valley in deep shadow, giving an indication of the effect of the topography on the amount of sunlight reaching the ground. This photograph was taken around midday in March. Photo: author.

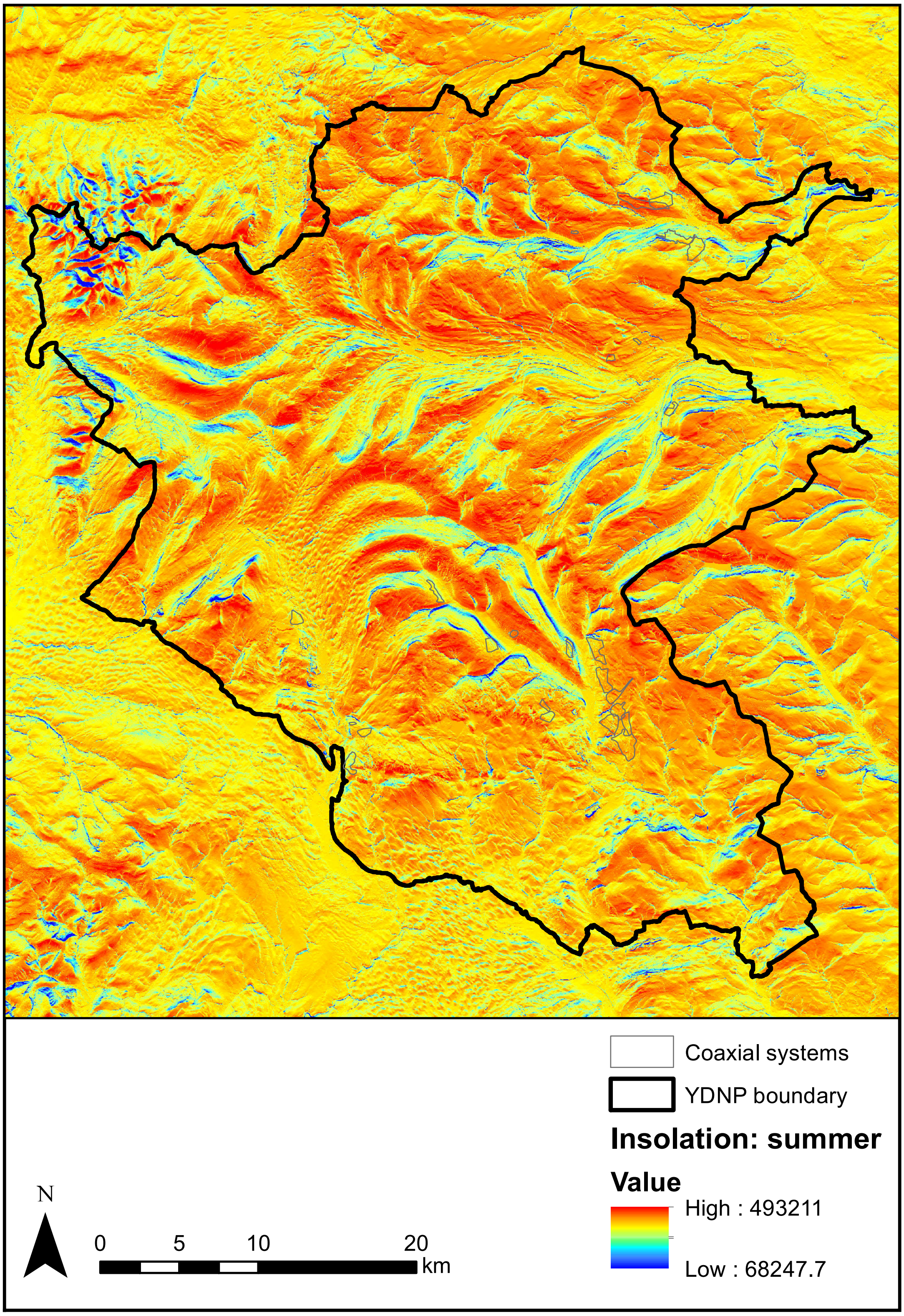


Fig. 5.56 Incident solar radiation (in kilowatt hrs) over the Yorkshire Dales National Park, calculated for 1st June 2016 - 31st August 2016

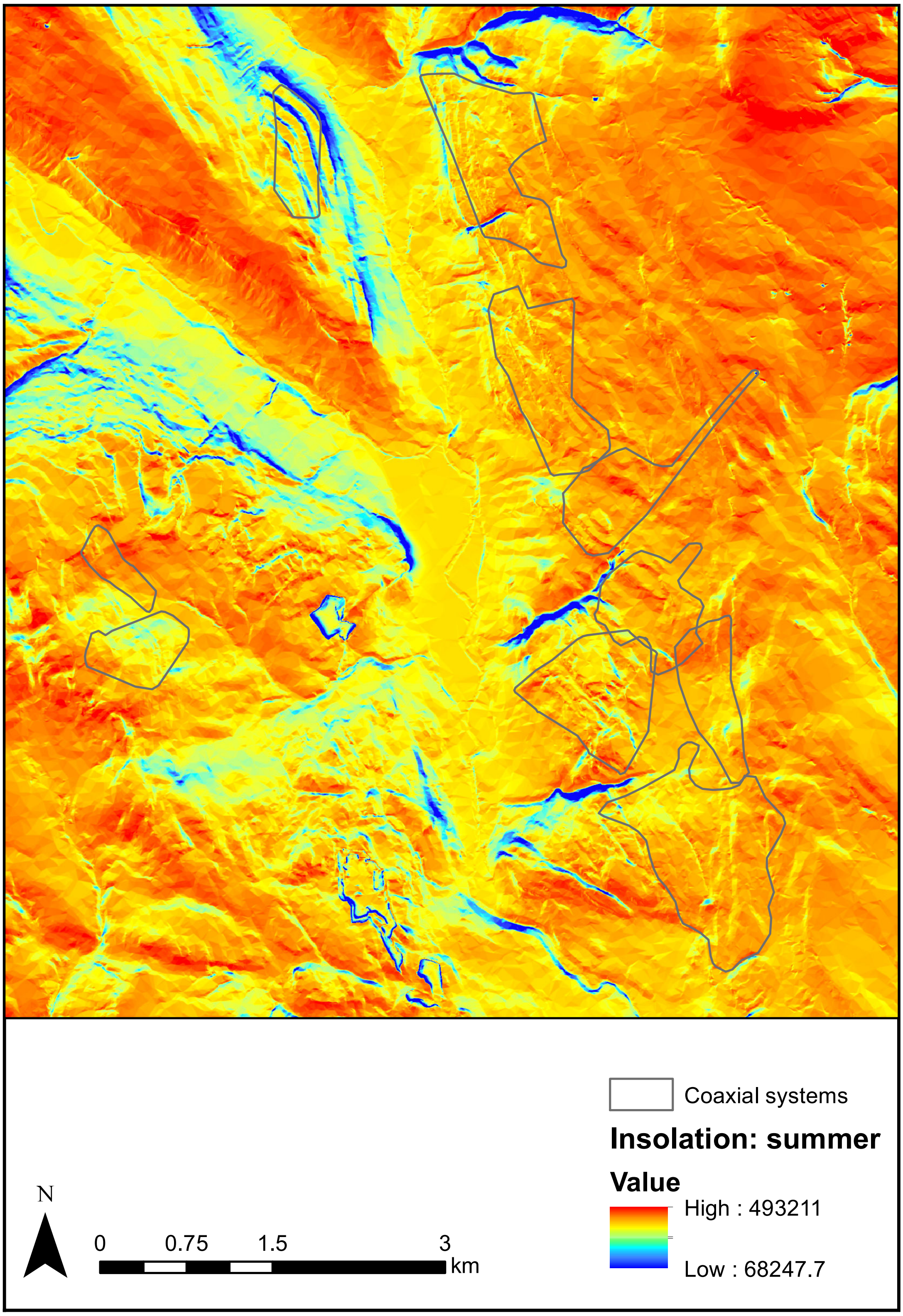


Fig. 5.57 Incident solar radiation (in kilowatt hrs) over part of Wharfedale, calculated for 1st June 2016 - 31st August 2016.

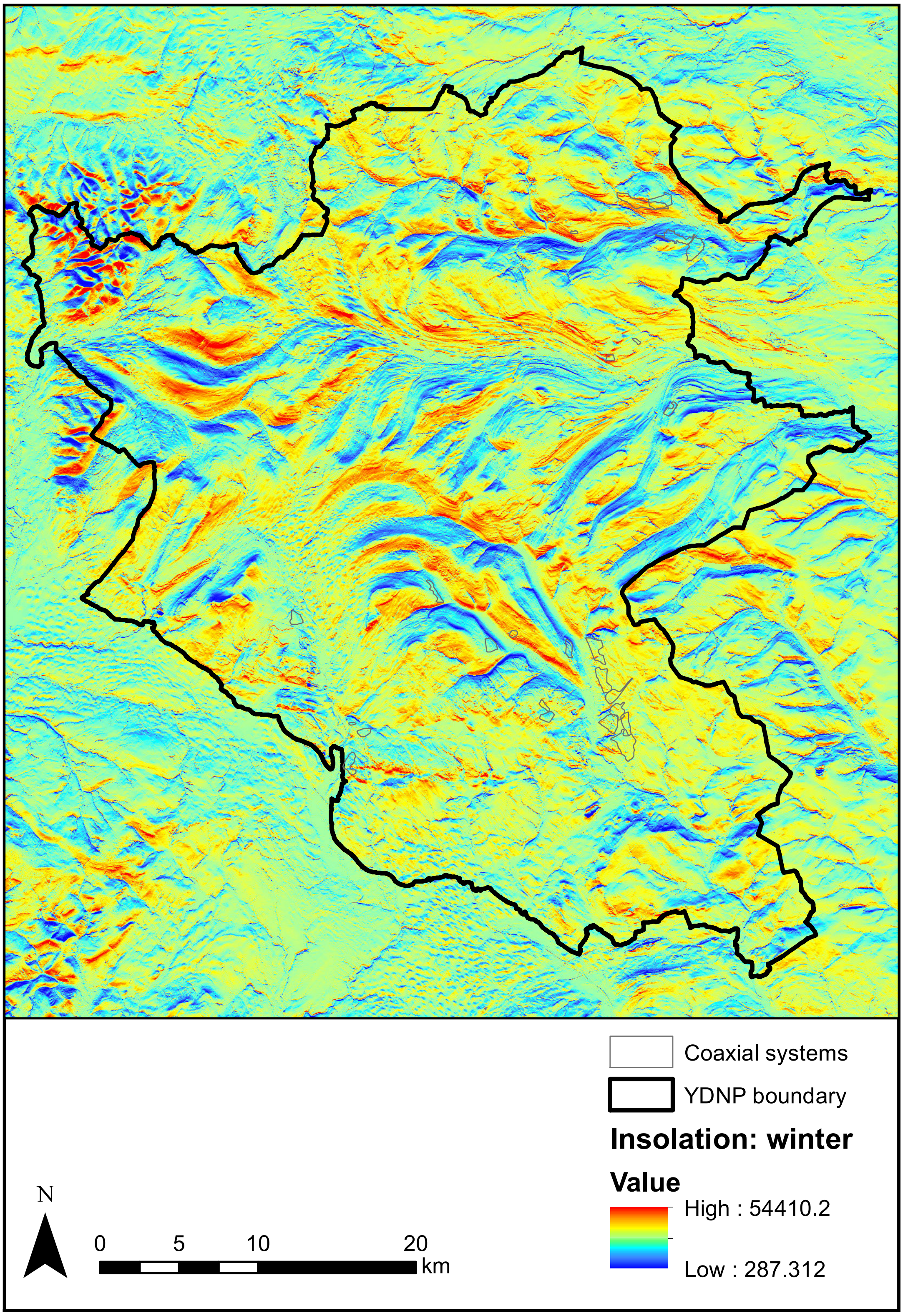


Fig. 5.58 Incident solar radiation (in kilowatt hrs) over the Yorkshire Dales National Park, calculated for 1st December 2015 - 29th February 2016.

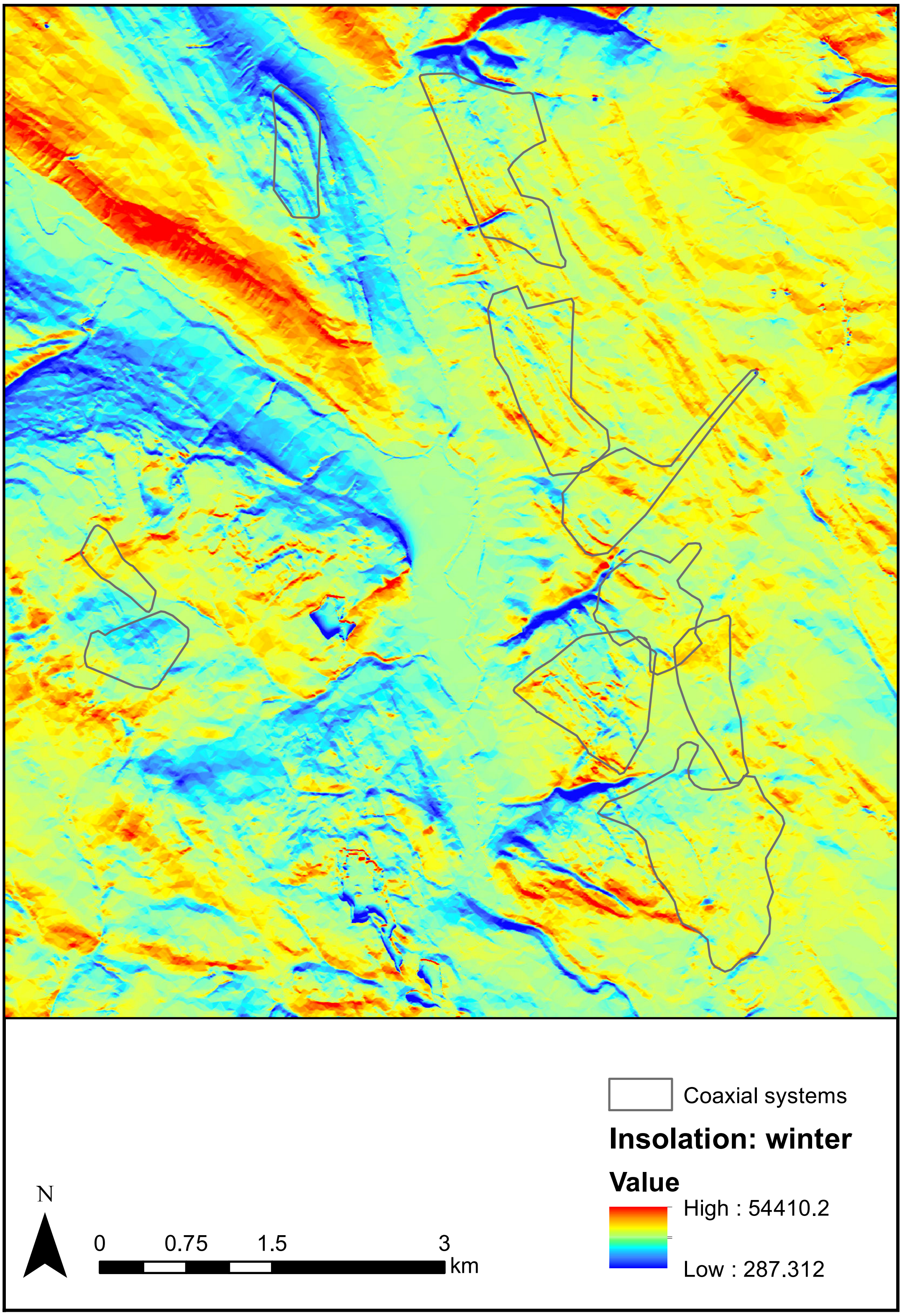


Fig. 5.59 Incident solar radiation (in kilowatt hrs) over part of Wharfedale, calculated for 1st December 2015 - 29th February 2016.

5.5.6 Soils

Twenty of the twenty-four systems identified are situated on soils high or variably high in calcium carbonate; soils in mid Swaledale have low calcium carbonate levels (Edina Digimap 2016). While this is perhaps inevitable, given the extent and variety of limestone geology in the region, it also gives an indication of the resources available to land owners or users. Once enclosed for grazing, it would only take several generations before it became species-rich calcareous grassland, and it may be possible to think of the coaxial strips much like the later medieval and post-medieval ‘intakes’ whereby former waste, moorland or wood was enclosed and improved for grazing.

Alongside other minerals, Galena is found extensively across the north of the Dales and across Grassington Moor, as demonstrated by a substantial body of evidence for mining, which ranges from inscribed Roman pigs of lead, the remains of shallow shaft activity and hushes to the large smelting complexes of the eighteenth and nineteenth centuries. While there is no recorded exploitation of the mineral resource prior to the Roman period, it would seem unlikely that such activity did not occur.

5.6 Summary

The majority of coaxial systems of the Yorkshire Dales share a number of recognisable common features, although within the Park there are also variations and differences. The most striking aspects of their presentation are their direct straightness, as well as their definitive parallel arrangement. On closer inspection, however, it seems that the boundaries of the major systems of Swaledale are more sinuous than those identified in the southern dales - this distinction is visible in the lidar data, and is not only a symptom of the Swaledale boundaries having been surveyed on the ground at a closer scale than others. The composition of the boundaries is such that all identifiable remains are now of stone, although this is not to say that other elements were not present. From surface observation and what little excavation has taken place, it is evident that their construction varies, with investigations in Swaledale (Fleming 2010) and Wharfedale (Raistrick 1937; Cardwell *et al*. 1990) identifying both faced walls and clearance-style profiles.

In terms of their layout, the parallel boundaries are almost always arranged at right angles to the contour, the exception being at Reeth where the system forms a ‘net’ over an extending spur, still aligned with the principle direction of the hillside. Characteristically, many of the systems are connected to the underlying landscape through their apparent use of pre-existing features, such as limestone scars and sudden changes in gradient, as an alternative to artificial boundaries. The boundaries are not equidistant, but frequently lie between 30 and 60m apart; the density with which they were laid out varies across the Park (assuming similar levels of preservation). The most obvious infilling between boundaries can be seen as the result of obvious redevelopment and reuse, namely, in the case of Grassington-Kettlewell system 6, while the more detailed survey of some of the Swaledale systems offers an indication of the potential internal ‘detail’ that once existed in the other systems, tending towards settlement and cairnfields.

Located on the higher valley sides, neither on the (potentially) wet flood plain of the valley floor nor amongst the bog of the high gritstone moorland, the parallel axials run perpendicular to the main valley, dividing up the resources of the zone. In each case the aspect of the land varies, with the aspect of systems perhaps dependent as much on the local topography as any intentional planning, although the relative paucity of north facing systems may be deliberate. On average, the orientation of the boundaries themselves tends slightly towards the northeast/southwest and southeast/northwest, implying a link with solstitial alignments. Analysis of rainfall data suggests that the coaxial systems are to be found in the lea of the Pennine peaks.

6. The coaxials of the Yorkshire Dales National Park in their wider context

The plutonic granite of Dartmoor forms a discrete upland landscape well known for its preserved archaeological remains. The coaxial systems, which extend over a considerable area and demonstrate excellent preservation, provide the classic example of land division of this type (Fleming 2008). As such, although a myriad of questions remain unanswered, they have served as something of a focal point for work on the subject and have received a relatively great quantity of attention compared to the field systems of the Yorkshire Dales (see Fleming 1978; 1983; 1987; 1994; 2008; Butler 1991-1997; Earle 2002; Wickstead 2008b). On both counts, they provide a useful comparison for those of the Dales almost as a matter of course. In many ways they also demonstrate great morphological similarities, in an upland landscape that provides many parallel challenges both to the users of the field systems and to the archaeologist. The coaxial field systems of the Yorkshire Dales may be idiosyncratic, but similar late prehistoric field systems are known from a variety of settings. This chapter will consider the form and functions of the boundaries of the Yorkshire Dales in the light of known examples from elsewhere in the UK and northwestern Europe.

6.1 Comparative case studies

6.1.1 The Dartmoor reaves

Coaxial systems in the Dales and on Dartmoor can both attribute good preservation to their location on what has since been seen as ‘marginal’ land, experiencing a low population density and what is perceived as minimal-impact land use. In addition to being rugged upland terrain, as national parks, both the Dales and Dartmoor are conserved landscapes and the archaeology in them largely statutorily protected. Hence, the potential for intrusive investigation is somewhat limited and large-scale excavation impractical. Moreover, both areas present individual circumstances that make fieldwork problematic. For example, geophysical magnetic survey, so often a fieldwork staple, is made difficult (though not impossible) on Dartmoor due to the granitic bedrock (Johnston & Wickstead 2005) and in the Dales due to the complex subsurface gryking in limestone areas, in addition to the surface obstacles of upland moorland and rough pasture.

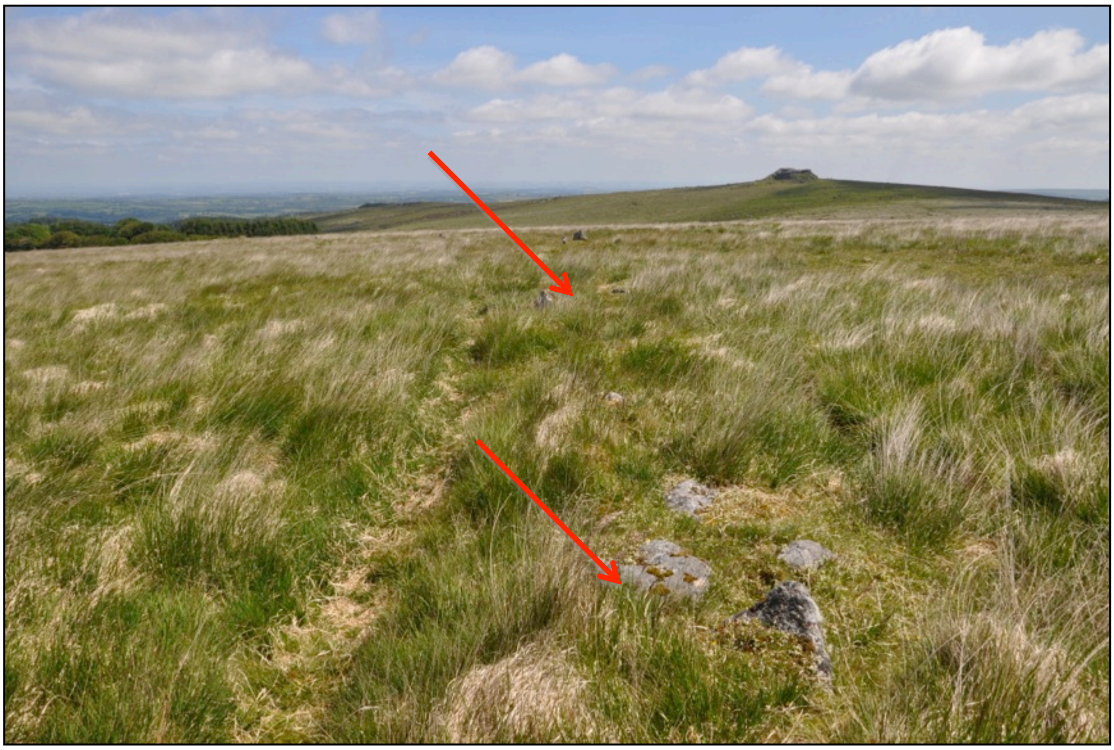


Fig. 6.1 Boundary reave (marked) on Shovel Down, Dartmoor, looking northeast towards Kestor. Photo: author.

Although the reaves were recognised as land divisions in the early nineteenth century, they were subsequently interpreted as trackways (see Fleming 2008: 21) and as medieval fields (see Fleming 2008: 30-31) before re-evaluation as prehistoric field systems (Gawne & Somers Cocks 1968; Fleming & Collis 1973). The work of the Dartmoor Reaves Project, begun in the mid 1970s, involved some six seasons of excavation on Holne Moor that took place throughout the late 1970s and 1980s (Fleming 2008: 92-118) in addition to the mapping of reaves from the air and in the field (Fleming 2008: 35-91). Consequently, Fleming developed an interpretation centred on the reaves as territorial divisions, formalized over a short time span in response to the grazing pressure of a 'Commons Dilemma' (Fleming 1978; 1983) (fig. 6.2).

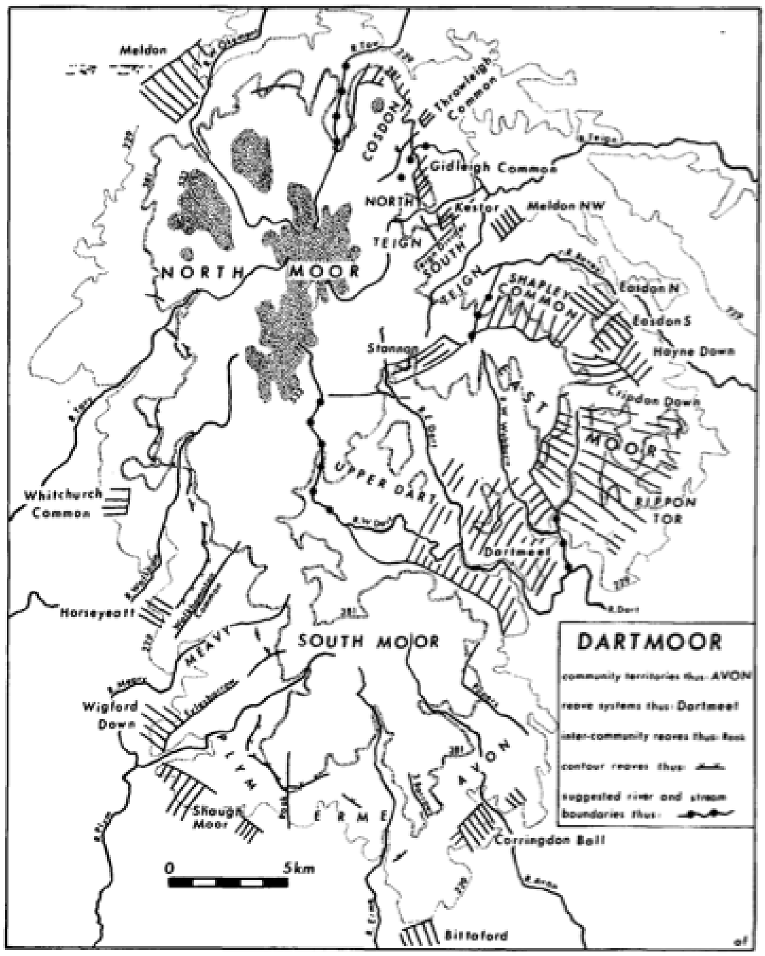


Fig. 6.2 Fleming's simplified schematic map of the main reave systems on Dartmoor. (Reproduced from Fleming 1983: 221, fig. 9.)

More recent work has focused on reaves and associated settlement on Shovel Down, on the northeast of Dartmoor (fig. 6.3), with the aim of understanding the process of land enclosure here and challenging Fleming's interpretation of a rapidly imposed planned reave layout by illuminating chronological depth and accretionary growth (Brück *et al*. 2005). Specifically, this has centred on the investigation of joints, structure and construction of sections of the major local reave, alongside collection of dating evidence, geophysical survey, auger survey and palaeoenvironmental work (Brück *et al.* 2005; Brück *et al.* 2004; Johnston *et al*. 2003). Meanwhile, Wickstead has approached the study of the Middle Bronze Age reaves from the perspective of their potential import for the meaning of land tenure (Wickstead 2008b).

Fig. 6.3 Part of the prehistoric settlement evidence of Shovel Down, Dartmoor. Photo: author.

6.1.2 The coaxials of the southern/eastern English lowlands

This chapter will also make use of evidence from the Thames Valley and southern/eastern English lowlands. In addition to the contrast offered by a strikingly different landscape scenario and perceived socio-political situation, the evidence provides some interesting equivalences, including the coaxiality of boundaries. Although the evidence from each stem from different sources, reinforcing the differences, it is arguable that the modern division between the intensively used lowlands and 'marginal' upland may have been less of a dichotomy in later prehistory, especially if animals were moved seasonally on a greater scale than today. Indeed, Fleming suspects that the largest reave system on Dartmoor originally spilled over the eastern edge of today's moor and made its way down towards Ashburton in the surrounding lowlands (Fleming 2008: 65).

In practice, given the density of historic land use in these areas, in-depth examination of coaxial field systems, of which no surface trace remains (beyond possible cropmarks), has been a post-PPG16 activity. The rate and scale of development, and thus developer-funded archaeology, has been such that many individual interventions have produced valuable insights (as at Perry Oaks (Lewis *et al*. 2006; 2010)), while synthesis of the associated grey literature has resulted in a remarkably full picture of prehistoric landscape modification (e.g. Yates 2007). Using material that can be firmly dated to the Middle and Late Bronze Age and Earliest Iron Age (Yates 2007: 9-10), Yates has shown that within the Thames Valley, and the southeast of England more generally, linear field systems - including those with a dominant axis - are to be found in localized 'enclaves' apparently governed by the proximity of the coast, estuaries or major rivers, and possibly associated with politicised 'prestige goods economies' (Yates 2007).

One such enclave is located on the Heathrow gravel terraces to the west of London, and incorporates some of the most concentrated areas of Middle/Late Bronze Age coaxial fields in the Thames Valley in an area largely enclosed by the Rivers Colne, Thames and Crane (Yates 1999; 2007: 33, fig. 4.2). Connected chronologically with both the riverside regional power centre at Runnymede-Petters and a proliferation of river-deposited metal work, the development of a managed landscape has been revealed through extensive excavation such as that at Perry Oaks (fig. 6.4) (Lewis *et al*. 2006; Lewis *et al*. 2010), which has recovered valuable evidence in the form of artefacts and environmental samples on a much wider scale than the research excavations of the uplands.

Fig. 6.4 Excavated 2nd and 1st millennia BC landscape at Terminal 5, Heathrow (Perry Oaks). Note the aggregated landscape to the western end of the excavation and the coaxial landscape layout to the east, separated by possible common land. (Reproduced from Lewis et al. 2010: 134, fig. 3.1).

6.1.3 Other comparative examples

This chapter will also draw on, albeit to a lesser extent, a number of other examples that illuminate those of the Yorkshire Dales through their similarities and differences. For example, the prehistoric landscapes at Céide Fields, located on the coast of County Mayo, Ireland, and best known for their Neolithic coaxial field systems (fig. 6.5), offer potential commonalities with those of the Yorkshire Dales, ranging from their similar geology and current 'marginal' status - Ceide is situated on layers of limestone sandstone and shales and, at around 50 to 200m aOD, is now covered in blanket bog and heather - to the morphology and scale of the fields. The late prehistoric fields of the southern chalk uplands are also considered, in so far as some of the boundaries demonstrate coaxiality in layout (McOmish *et al*. 2002). Where Yates has identified lowland Middle/Later Bronze Age coaxial boundaries to the south of the Wash-Severn line, a series of Iron Age/pre-Roman 'brickwork' fields in north Nottinghamshire and South Yorkshire, known through aerial photography and excavation (Riley 1980; Chadwick 2008; 2013), extends this corpus in time and space.

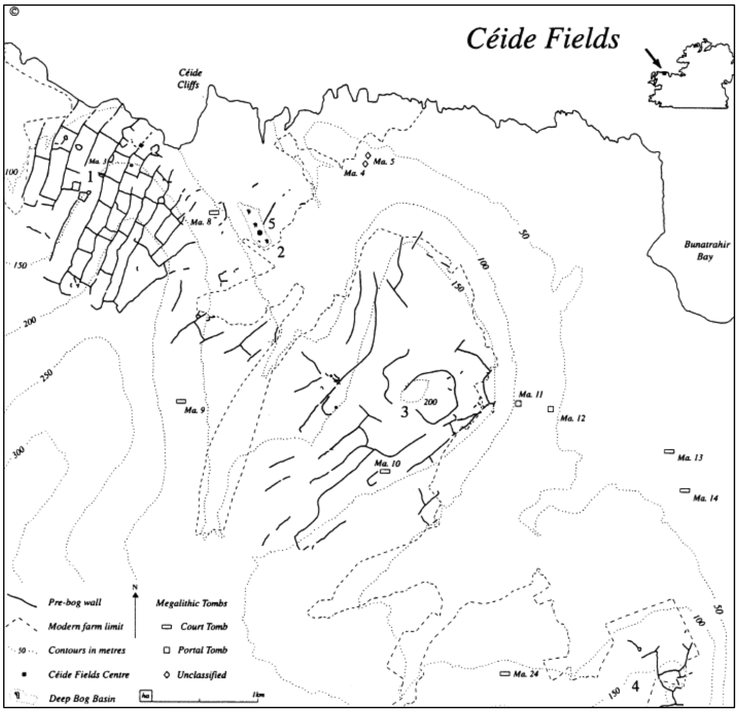


Fig. 6.5 Map of coaxial Neolithic field systems at Céide Fields, Co. Mayo, Ireland, illustrating its morphological similarities to the systems of the Yorkshire Dales.

6.2 The boundaries

6.2.1 Stone boundaries: morphology and structure

To summarize Section 5.1, the boundaries of the Yorkshire Dales are comprised of local stone, of which there is a plentiful supply. Limited excavation has revealed some to be built of facing stones and a rubble core, while others appear to be formed by stone clearance, perhaps along a fence line or similar. They can be detected by surface observation as either low, turf-covered banks (in areas of short cropped pasture, for example above Grassington, Wharfedale, fig. 4.3), lines of tumbled stone (in areas of burnt heather, such as Swaledale, fig. 4.5-4.6) or rows of moss-covered, small-medium boulders of various separations (for example, above Conistone, Wharfedale).

The structure and composition of the Dales boundaries appears similar to that on Dartmoor, where boundaries are also composed of pieces of the local stone (granite, in the case of Dartmoor) (figs. 6.1). Fleming notes that boundaries of the Healaugh system in Swaledale were faced (Fleming 2010: 140), while some of those of a possible coaxial system at Appletreewick, Wharfedale, also comprised regularly laid facing stones with a rubble core (Cardwell *et al.* 1990: 5). The majority of boundary sections investigated on Holne Moor, Dartmoor, were also “proper” walls with evidence for facing on both sides (Fleming 2008: 107, fig. 50). Excavation by Johnston *et al*. provides further detail and reveals variation in structure within and between boundaries in three trenches at Shovel Down, which can be cited as evidence for the dynamic development of the system over a long period of time (Johnston *et al*. 2003). The well-preserved boundaries range from largely unstructured (Trench C) to, in places, surviving to a maximum of four courses (Trench B), with tumble suggesting an original height of around 5 courses (*c*. 0.6m). These walls, illustrated in fig. 6.6, were:

> constructed using carefully placed outer facing blocks with an infill of smaller, more irregularly laid stones together with a quantity of earth…The facing stones were of varying size (<350mm) though they were proportionally larger than those in the core (<116mm)…The second course of facing mirrored this pattern but stones of intermediate size were selected, while the third course was made up of smaller stones laid flat, but with their long axes set into the wall rather than along the direction of the face…[to allow] the upper course to have been ‘tied into’ the other stones in the wall…At various places…a distinct layer of ‘capping’ stones could be identified…[consisting of] large slab-like blocks laid flat as if they were ‘paving’ a level within the wall (Johnston *et al*. 2003: 5).

On Shovel Down, standing remains had similar dimensions to those in the

Dales, with widths of 0.85-1m, 1.5m and 1.65m wide, and heights of 0.3-0.6, 0.15-0.25m and 0.2-0.4m high (Johnston *et al.* 2003: 5-8).

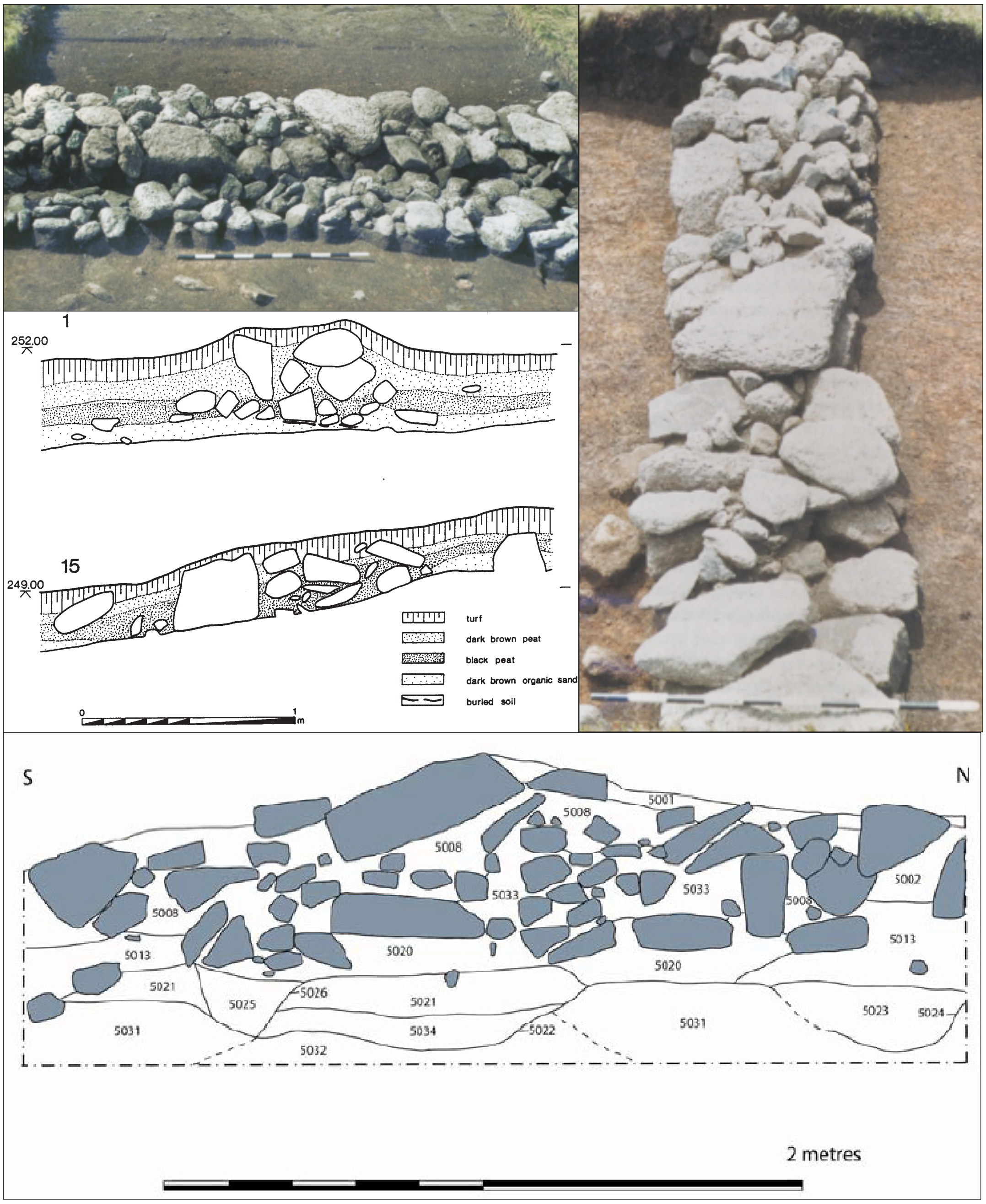


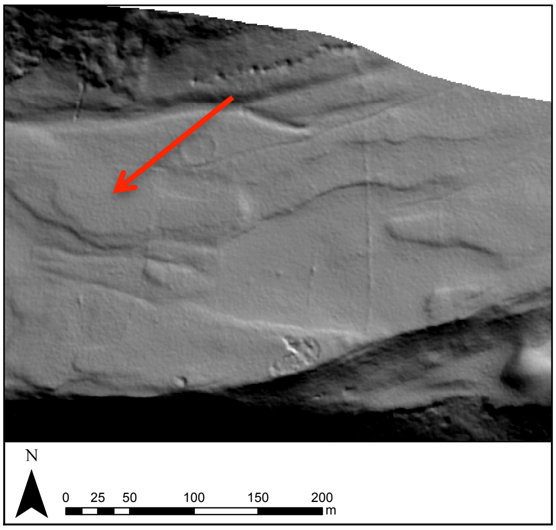
Fig. 6.6 Structure of coaxial boundaries on Dartmoor and in the YDNP. Top left: Fleming's excavation of a boundary from Site G on Dartmoor part way through excavation; note the clearance stones piled against the face. (Reproduced from Fleming 2008: 107, fig. 51.) Top right: the same boundary after removal of tumble. (Reproduced from Fleming 2008: 107, fig. 50.) Left: cross sections of linear boundaries from the possible coaxial system at Appletreewick. (Reproduced from Cardwell et al. 1990.) Bottom: section through Shovel Down axial boundary (Leat 1 Trench) indicating the mixture of larger stones and smaller fill material (with tumble). (Reproduced from Johnston et al. 2003: 10, fig. 6.)

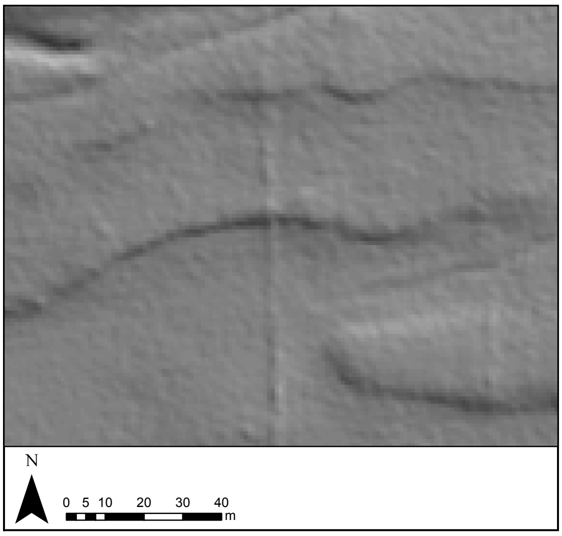
Similar faced and unfaced stone boundaries have been recorded in uplands elsewhere, including at Céide Fields, Co. Mayo, (fig. 6.7) and on Bodmin Moor (Johnson & Rose 1994: 63) and Exmoor (Riley & Wilson-North 2001: 43-44); their appearance and construction, if not their overall layout, is also similar to prehistoric upland field boundaries that are not coaxial, such as those at Leskernick, Bodmin Moor (Bender *et al.* 2007: 219-220) and Rougher Hill, The Burren, Co. Clare (Jones 2008: 50). On the other hand, not all upland boundaries share the structure of those of the Yorkshire Dales. While the low stoney banks of the field systems on the chalk of Salisbury Plain Training Area, for instance, bear an initial resemblance and utilize cleared stone, they are primarily the result of lynchet formation, presumably along boundaries already marked in some way (McOmish *et al*. 2002: 51-52). The boundaries of many 'Celtic' fields, including those in Denmark and Sweden (Hatt 1931; Petersson 2008) also appear similar to the stone boundaries of the Dales, though others, predominantly those in the Low Countries, comprise a reticulated pattern of sandy banks that separate approximately square-rectangular enclosures, and, in their later phases, may have been added to in order to facilitate cultivation on the banks (Spek *et al*. 2003; Arnoldussen 2016).

Fig. 6.7 Excavated boundary at Céide Fields. Photo: author.

As mentioned in Section 5.1.1, it is generally assumed that these boundaries would have been topped by a hedge as a means of forming a stock-proof enclosure (although stock-proofing need not necessarily have been a prerequisite, given the possibilities afforded by shepherding). Even with a hedge, the limestone boundaries of the Dales would have stood out, pale and bright, when new. While there is little categorical proof for hedgerows *per se*, there is evidence such as that from Balby Carr, South Yorkshire: Roberts reports that waterlogged ditches of trackways and enclosures of 'brickwork' fields yielded macrofossil evidence of hedgerow plants including Hawthorn and Buckthorn (Roberts 2008: 199). Pryor has reasoned that the ditches bounding lowland field systems are not intended as the primary boundary but function to provide the material for a bank, the shallow depth of both indicating that it was not intended as an impediment to stock but as a planting medium for the hardwood cuttings of a newly laid hedge (Pryor 2006: 85-87). By way of contrast to the stone boundaries of the Dales and other uplands, no above-surface evidence of stone boundaries remains, if it originally existed, from the lowland coaxial systems, which seem to have been divided by hedges/ditches alone.

Interestingly, some of the Yorkshire boundaries - those in Swaledale - appear from the lidar data, aerial photographs and EDM plans that exist for these systems, to be more sinuous than those of the southern dales (as well as Fleming's well-known schematic plans of earthworks on Dartmoor); 'wiggles' and kinks such as those present in Saddlesborough Reave (fig. 6.13) are visible in these datasets. The most conspicuous aspect of coaxial boundaries, namely their apparently unwavering straightness, has been challenged in recent years, by the suggestion that this appearance is a function of the scale at which they are viewed (Johnston 2005: 3). As Johnston puts it, the 'mismatch' between the coaxial pattern and the variation of individual boundaries "demonstrates the working of individual agencies within the material conditions of an existing socialized landscape" (Johnston 2005: 3). The morphology of Saddlesborough reave has been examined primarily through excavation, therefore the equivalent data is not available for the systems of the Yorkshire Dales, however, an attempt has been made here to compare the localized variability of the individual boundaries from the surface remains by the examination of 1m resolution lidar data. While the southern Dales boundaries are not without their wiggles, these tend to be discrete, contained interruptions of a more direct feature, whereas the Swaledale boundaries maintain their overall alignment but wander more freely down the hillside.





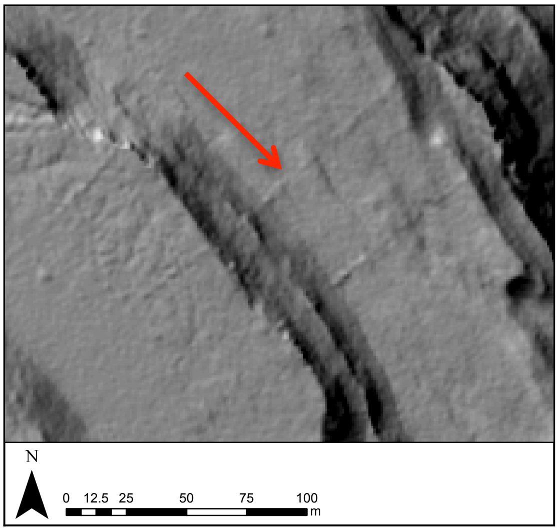


Fig. 6.8 Above left: straight axial boundary of the Carperby 1 system, demonstrating slight change of direction as the land rises towards the edge of the plateau (bottom of the frame). An enclosed cremation cemetery/ring cairn (MYD1221) is also visible. Above right: close up view of the same. Below: axial boundaries of the Middlesmoor Pasture system (Wharfedale),

(interrupted by quad bike tracks). (Derived from Environment Agency lidar data. Angle of light source 45º, azimuth 315º.)

Unfortunately lidar data is not available for the majority of the Grassington-Kettlewell systems, but these also appear very straight in aerial photographs (fig. 6.9) and further examination would be interesting.

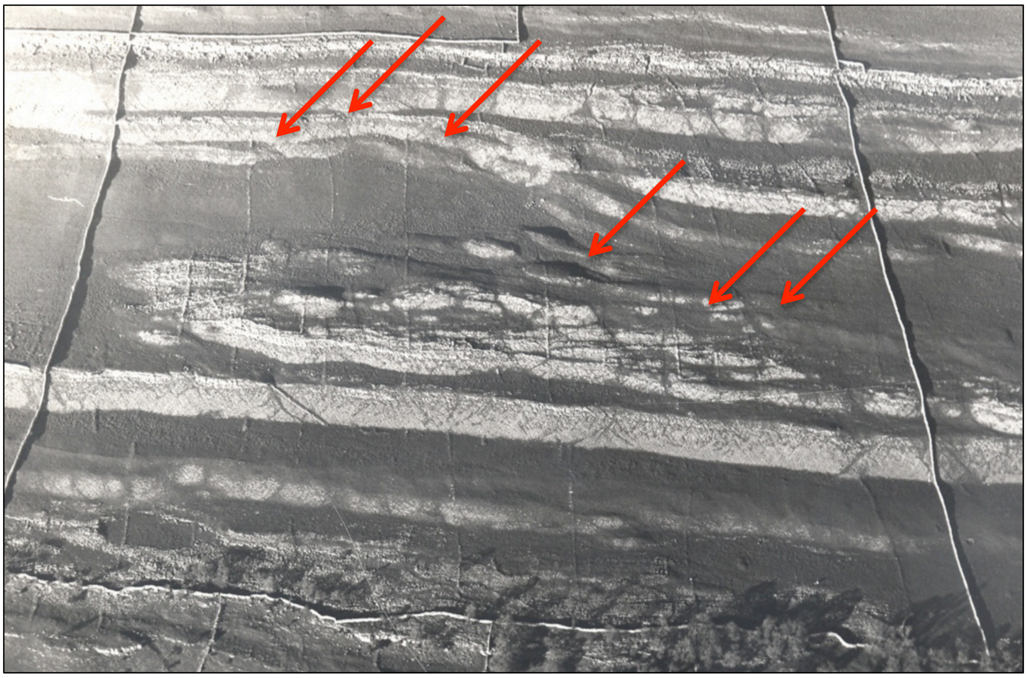


Fig. 6.9 Aerial photograph of the eastern side of Wharfedale south of Kettlewell; boundaries of Grassington-Kettlewell system 2 are visible (marked). Photo: YDNPA DNR 1060-34.

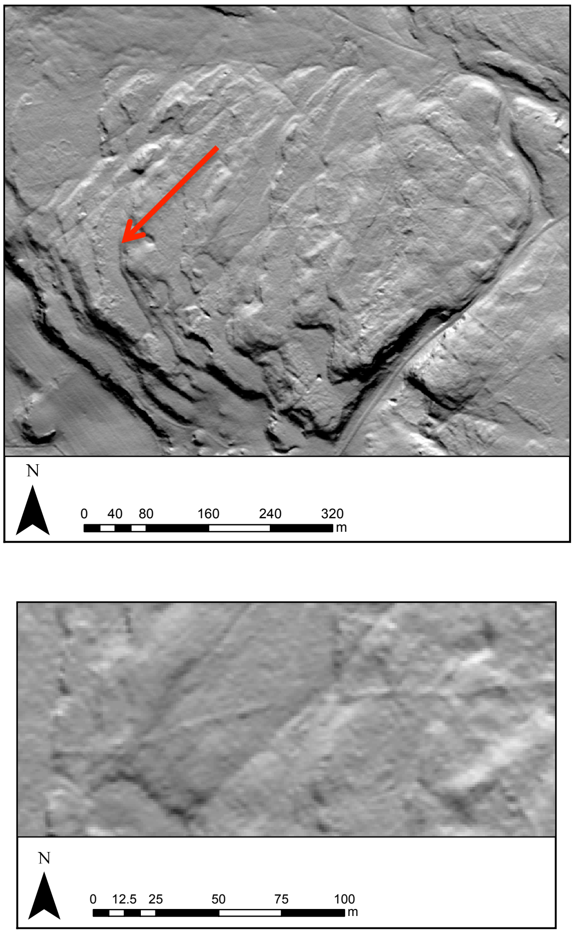


Fig. 6.10 A boundary of the Stainforth coaxial system (Ribblesdale) demonstrating a deviation from its otherwise direct route. (Derived from Environment Agency lidar data. Angle of light source 45º, azimuth 0º.)

It is noticeable that the boundaries of the Grassington-Kettlewell 6 system, which, as already discussed, have seen extensive remodeling, appear more 'defined' than those of other systems in both the 1m and 25cm lidar data. This may be the result of better preservation (through continual reuse) and more complete turfing over. They also appear more kinked and with a greater variety of widths, which can perhaps be put down to a difference in (re)construction circumstances.

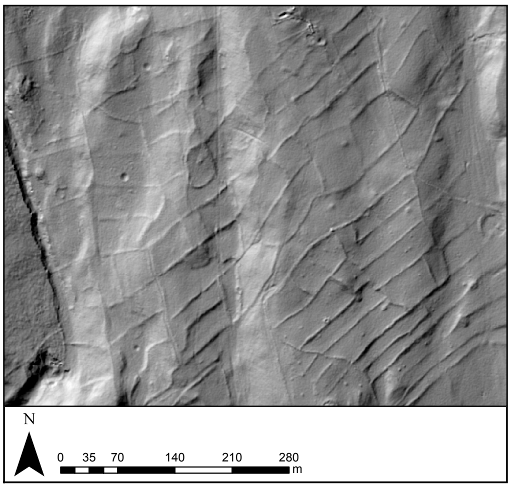


Fig. 6.11 Lidar hillshade plot of part of Grassington-Kettlewell system 6. (Derived from Environment Agency data. Angle of light source 45º, azimuth 315º.)

On the other hand, what is visible of the boundaries in Swaledale suggests that the axials here are considerably more sinuous than those further south.

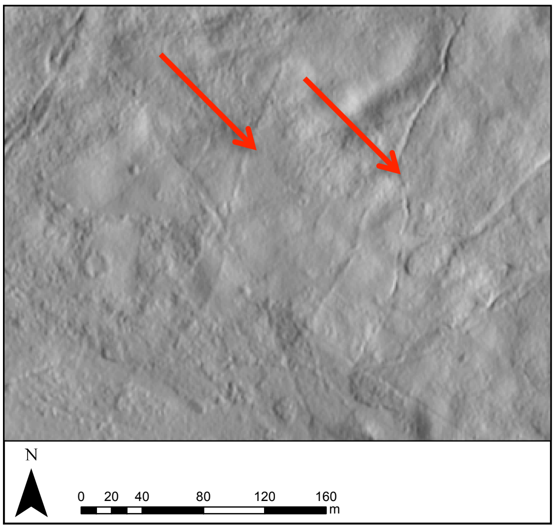


Fig. 6.12 Lidar hillshade plot of boundaries of the Harkerside system. (Derived from Environment Agency lidar data. Angle of light source 45º, azimuth 90º.)

It may be that the southern systems appear so as the individual boundary sections tend to be shorter, due to the terracing of the valley sides, reducing the prevalence of what Fleming referred to as 'gang junctions', that is, small disconformities in the line of a reave where the construction process, being undertaken by two or more individual groups, met, or simply that construction was less prone to deviations over a shorter distance before a scar was reached. Alternatively, if the dalesides of Swaledale had been extensively managed before the building of the coaxial boundaries - and the prevalence of clearance cairns and other features imply parts of them may have been - then the coaxial framework may have developed from existing boundaries, as opposed to being newly laid out with the sole intention of forming coaxial strips - the latter approach could be expected to result in more direct lines.

The excavation of a single stake hole from beneath a short stretch of axial boundary on Calverside, Swaledale (Fleming & Laurie 1985: 2), is not sufficient to build an argument, but it is a tantalising suggestion that the Dales boundaries were not the original land divisions, at least in some places. Excavations on Shaugh Moor, Holne Moor and Shovel Down, Dartmoor, suggest that the reave structures have intricate biographies, parts of which involve ditched, trackwayed or fenced predecessors. Cross-sections through Saddlesborough Reave, for example (see fig. 6.13), show it to have varied both along its length and through time, being variously represented by a wide, shallow ditch, a trackway for animals, a ditch with accompanying bank, a free-standing timber boundary without ditch or bank, and a continuous stone wall accompanied by the silted up ditch (Johnston 2005: 4): Johnston argues that the formalization of land division was possible because the underlying means already existed (Johnston 2005: 17).

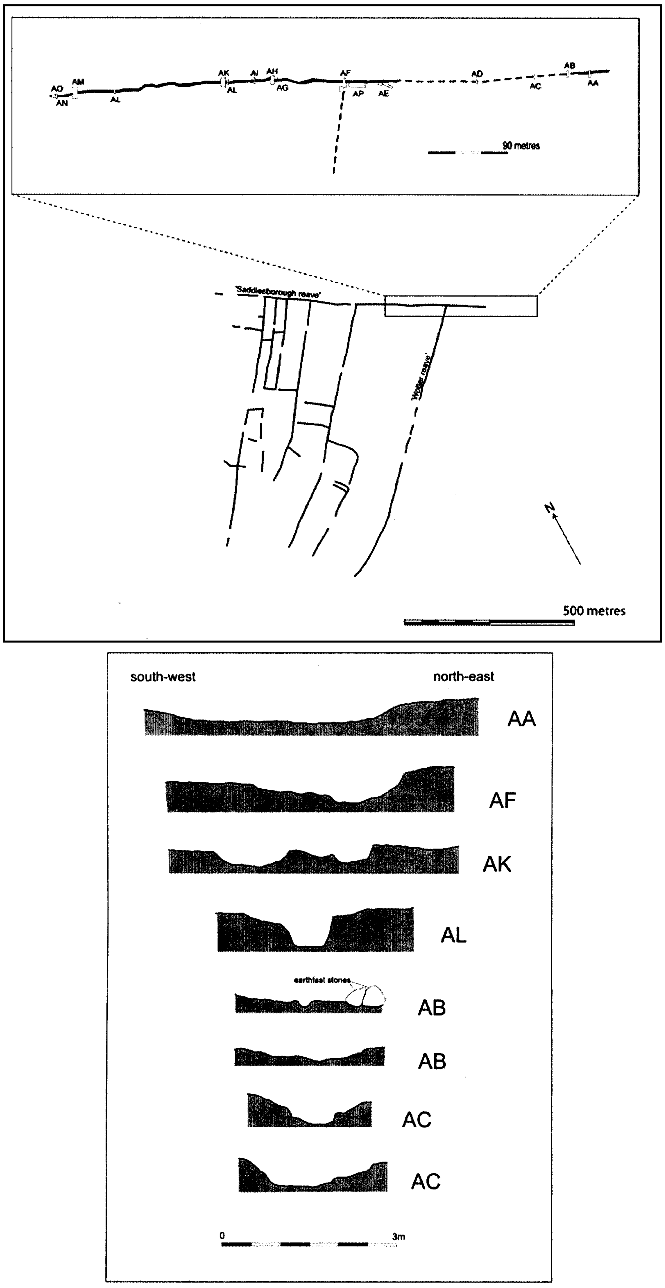


Fig. 6.13 Left: plan showing part of the system of coaxial boundaries on Shaugh Moor, southwest Dartmoor. The letters indicate the locations of rescue interventions along the terminal Saddlesborough reave conducted in the late 1970s. (Reproduced from Johnston 2005: 5, fig. 3.) Right: profiles through the ditch of the Saddlesborough reave. (Reproduced from Johnston 2005: 6, fig. 4.)

If the Dartmoor reaves themselves had accretive biographies, then the systems as a whole also show evidence for episodic accumulation rather than having been entirely laid out in one synchronous operation, as favoured by Fleming (Fleming 2008; 1994) - it is very likely that the systems of the Dales developed and were modified in a similar fashion. Excavation of reave junctions on Shovel Down indicated that the expected chronology - that is, that the main Shovel Down axial reave was laid out, followed by lesser boundaries enclosing plots perpendicular to it - had to be revised: at a T junction with the axial reave, the ‘lesser’ boundary was found to be keyed into and built to form part of the western element of the axial, with the eastern part of the axial abutting the corner at a later point in time. This is cited by the excavators as evidence that the formation of the system was an incremental process (Johnston *et al*. 2003: 6), although it is not clear how much later in time the later work was carried out. The northern leg of the boundary showed evidence for rebuilding and a 1.9m gap with cobbled ground had been created to the east of the junction “some time after construction of this boundary” (Johnston *et al*. 2003: 7), suggesting a long life.

It was noted (Section 5.1.2) that a section of transverse boundary with staggered axial boundaries exists in Grassington-Kettlewell system 2, suggesting that it had served as a terminal boundary that had since been surpassed - this possibility is reinforced by evidence from Perry Oaks, where Lewis *et al*. suggest that the coaxial portion of the Bronze Age landscape was laid out in three broad phases, the southernmost being the earliest, on the grounds of radiocarbon evidence (Lewis *et al*. 2010: 138-139). It was found that the farmed landscape "resulted from a dynamic process of creation, maintenance and alteration of trackways, boundaries, entrances and fields, which were added to and altered throughout the second millennium" (Lewis *et al*. 2010: 143-5). Chadwick also offers an example of longevity of a ‘brickwork’ field system from Edenthorpe, South Yorkshire, where ditches demonstrated a great variety of fills and profiles, having been recut many times; fig. 6.14 illustrates at least three major realignments of the same field ditches (Chadwick 2008b: 225; 2013: 18-19). Insights gained from modern excavation elsewhere thus suggest that targeted excavation of Dales axials would be a worthwhile and valuable undertaking.

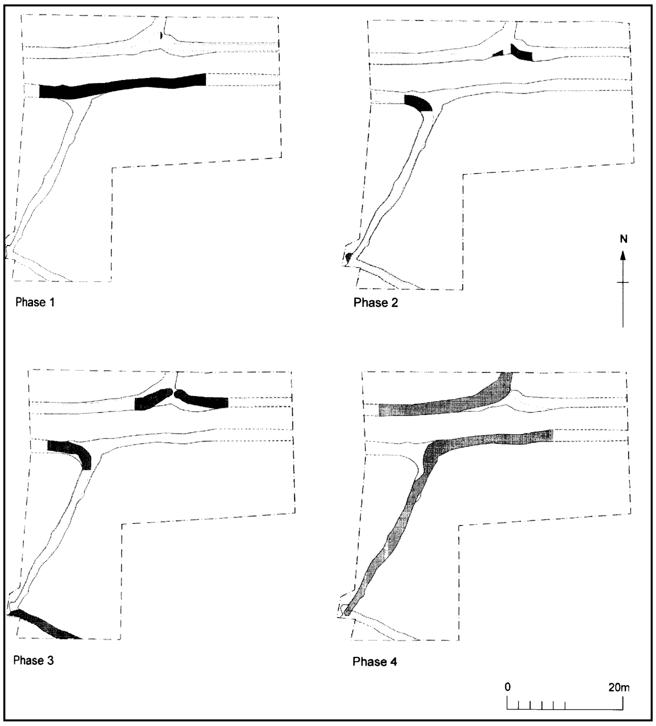


Fig. 6.14 Major changes of alignment detected by excavation at Edenthorpe, South Yorkshire. Recuts that continued the original position of the ditch are not recorded. (Reproduced from Chadwick 2008: 225, fig. 15).

6.2.2 Dates

The dating of the coaxial systems in the Yorkshire Dales is problematic, given the lack of suitable artefacts, materials or samples relating to either the fields or their boundaries. Fleming suggests a date of construction in the Iron Age (Fleming 2010: 145), although this is representative of a very localized situation. Given the probability of accretionary development and a long lifespan, the small number of radiocarbon dates cannot be confidently extrapolated across the rest of the system(s). A late prehistoric date hangs as much on morphological comparison with other systems as on the limited appropriate local investigations, yet this is also difficult given similarities with systems spread as far apart in time as, say, Céide Fields (Neolithic (Caulfield 1998)) and the systems of the Thames Valley (early Iron Age (Yates 2007: 112)).

While not quite as severe as the paucity of dating evidence from the Dales, the evidence from Dartmoor also relies on a relatively small number of radiocarbon samples (summarized in Wickstead 2008b: 41-44), including those from the Shaugh Moor Project (Balaam *et al*. 1982), Holne Moor (Burleigh *et al*. 1981) and, more recently, Shovel Down (Brück *et al*. 2005). These are not without their problems (those from investigations at Holne Moor, for example, lack the context of a fully published excavation report), however they have all been the subject of various recalibrations, the most recent of which, conducted by Wickstead (2008b: appendices F-H), argues for a window of construction between 1850 BC and *c.*1150 BC. Dartmoor has also been the scene of some further, associated, palaeoenvironmental work (see Caseldine 1999). Working on a section through an axial boundary that has been covered in peat - an integral part of the Shovel Down landscape and coaxial system - Fyfe *et al*. have used a combination of high resolution pollen analysis and fungal spore data to illuminate the alteration of the landscape from the Neolithic establishment of the first heath c.3630 - 3370 cal. BC and subsequent reappearance of woodland, to the development of species rich improved grassland around 1480 cal. BC and the less intensive use of the grassland from 1080 to 530 cal. BC (Fyfe *et al*. 2008). Given the temporal match between the (supposed) date of the reaves, the rich grassland flora of the pollen data (with little evidence of arable cultivation) and the presence of grazing indicator fungi, a cautious correlation is suggested between the "significant sustained modification" of the upland vegetation between c.1480 and 1080 cal. BC and the use of the subdivided fields for pasture (Fyfe *et al*. 2008: 2258-9).

Elsewhere, a broader campaign of radiocarbon dating and pollen analysis has been used effectively at Céide Fields to obtain a relatively robust date. Benefitting from both a secure stratigraphic context and well sealed archaeology, radiocarbon dates from the remains of almost 50 bog pines (*pinus sylvestris)* were used to obtain a *terminus ante quem* for the development of blanket bog in which they were growing, which in turn must be younger than the stone field walls beneath it (Caulfield 1978; 1983; Caulfield *et al.* 1998). As a result, field systems within the Céide area have been dated to the first half of the third millennium BC and must have been abandoned to peat growth by 2500 BC (Caulfield *et al.* 1998). Pollen analysis taken from a peat basin at Glenulra (within the area of Céide Fields) supports these dates, suggesting a pasture phase initiated by a *landnam* around 5100 BP, with developing moorland (including pine growth) from c.4600 to 4000 BP (Caulfield *et al*. 1998: 635; Molloy & O'Connoll 1995). These dates are interesting in that they relate to field systems that are morphologically very similar to those in the Dales (see figs. 6.5 and 6.7), yet (it is assumed) appear considerably earlier in the archaeological record.

As it becomes increasingly available, Optical Stimulated Luminescence dating has been used to effectively date the internal banks of 'Celtic' fields in the Netherlands, where the date of construction was identified as *c.*1100 cal. BC, with banks remaining in use for some 700 years (Arnoldussen & Scheele 2014: 66-7), highlighting the potential for the application of this technique elsewhere including the Yorkshire Dales, although it should be noted that sediment was found to be unsuitable in the case of High Park coaxial system in the Lune Valley to the immediate west of the National Park (Oakey *et al*. 2015: 60). The calculation of the differential rates of limestone dissolution beneath the Burren field boundaries is an as yet novel approach to dating field systems, but may prove of use in areas such as the Dales in the future (Jones 2016).

Overlap of the Healaugh and Reeth systems in Swaledale give an impression of the time-depth present, but the stratigraphic definition is not as clear-cut as that elsewhere. For example, at High Park a coaxial system forming part of a complex multi-period landscape has been argued to be Late Bronze Age or Early Iron Age in date based on stratigraphic principles: two large burial mounds, of a type conventionally dated to the earlier Bronze Age, were incorporated into the coaxial boundaries, while a *terminus ante quem* was provided by several overlying settlement complexes believed to be, on grounds of excavation and/or analogy, Late Iron Age or Romano-British date (Jecock 1998: 27).

It has been suggested that a prehistoric climatic downturn may have influenced the landuse and settlement of upland areas and the abandonment of the coaxial systems on Dartmoor (Caseldine 1999; see Amesbury *et al*. 2008: 87-8), although this is inevitably difficult to prove and relatively little relevant conclusive palaeoclimatic work has been carried out in the Dales (see Rushworth 2010; Turner *et al*. 2014). Despite a lack of direct proximity to any of the individual coaxial systems, work on testate amoebae and peat humification undertaken at Tor Royal Bog, Dartmoor, offers a complementary context to work on the systems themselves: this recorded a mild and stable climate between c. 2000-1455 cal. BC and a period of amelioration between c.1455 - 1395 cal. BC, followed by a downturn which lasted from c.1395 to 1155 cal. BC (Amesbury *et al.* 2008). While Amesbury *et al*. warn against environmental deterministic interpretations of these results (Amesbury *et al*. 2008: 95-96), the deterioration broadly coincides with the suggested date at which the reaves went out of use, with the potential for reuse of the grassland on a transhumant basis. It has also been noted that these results correspond with similar dates from northern Britain, suggesting climatic downturn at this time may have been a widespread event (see Amesbury 2008: 88) although implications for the Yorkshire Dales are unknown.

6.2.3 Terminal boundaries, infilling and transverse boundaries

Relatively few coaxial systems of the Dales demonstrate a visible terminal boundary of the sort so pronounced on Fleming's maps of Dartmoor systems. As established in Sections 4.4 - 4.8, a number of the Dales systems, such as Grassington-Kettlewell 1-6, appear to peter out upslope, coaxial strips apparently open-ended. This is unlikely to have been their original state when in use (although, if it was, it would hint at a role as a marker, perhaps for grazing rights or land ownership, rather than a physical preventative boundary), suggesting either the additional use of less visible boundary mechanisms (such as fencing or trackways, as were found to precede some reaves on Dartmoor (Johnston 2005)) or possibly the continuation in some areas of the boundaries higher up the hillside, now covered by peat and/or heather. Many of the Yorkshire systems give the impression of using a scar line or sharp change in gradient as an upper, or, indeed, lower terminal, the differential erosion of the valley sides being a characteristic feature of the Dales landscape. It may well have been the case that access above the terminal facilitated use of higher rough grazing land (similar to Fleming's territory model), perhaps for summer grazing, while coaxial strips served as enclosed winter quarters, above the wet valley floor (the Yorkshire rivers are said to be some of the quickest rising in Britain) and below the high fellside.

There is comparatively little evidence for infilling and transverse boundaries in the Yorkshire systems, even in Swaledale where transverse divisions are found most frequently. Wickstead used the fully bounded enclosures generated by transverse division of the axial boundaries on Dartmoor to assess Earle's redistributive chiefdom interpretation of land use (Earle 2002; Wickstead 2008b: 67). Having dismissed, on the grounds of lack of evidence, Earle's suggestions that Dartmoor demonstrates evidence for landscape features that characterise chiefdoms, namely central places and regional organisation 'from above', she was more taken with his idea that tenure itself may have been redistributed, for example as a reward for loyalty. In evaluating this suggestion, the area of 640 enclosures from nine systems were calculated and compared (this is not possible for the coaxial systems in the Dales, as few complete enclosures exist); the results showed very little standardization, with a large range of sizes, her conclusion being that this was not a landscape "with the kind of regular allotment that facilitates redistribution of tenure from the top down" (Wickstead 2008b: 68) - although it is something of an assumption that land units for redistribution would have to be equal in area.

Lowland coaxial landscapes, being subsurface, are difficult to compare as, due to the size of the systems, very few excavations pick up a complete system or, if they reveal a terminal, can put it in context or recognise its function.

Fig. 6.15 Above: Fleming's provisional plan of the southern part of the Dartmeet reave system on Holne Moor. Note the distinct terminal boundary, Venford Reave, and the frequency of subdivisions compared with the Yorkshire Dales systems. (Reproduced from Fleming 2008: 76, fig. 33.) Below Left: Aerial view looking south over the southern part of the Dartmeet reave system on Holne Moor. (Reproduced from Fleming 2008: 38, fig. 14.) Below Right: View of the southern part of the Dartmeet system on Holne Moor from the ground. Axial and transverse boundaries marked. Photo: author.

6.2.4 System dimensions

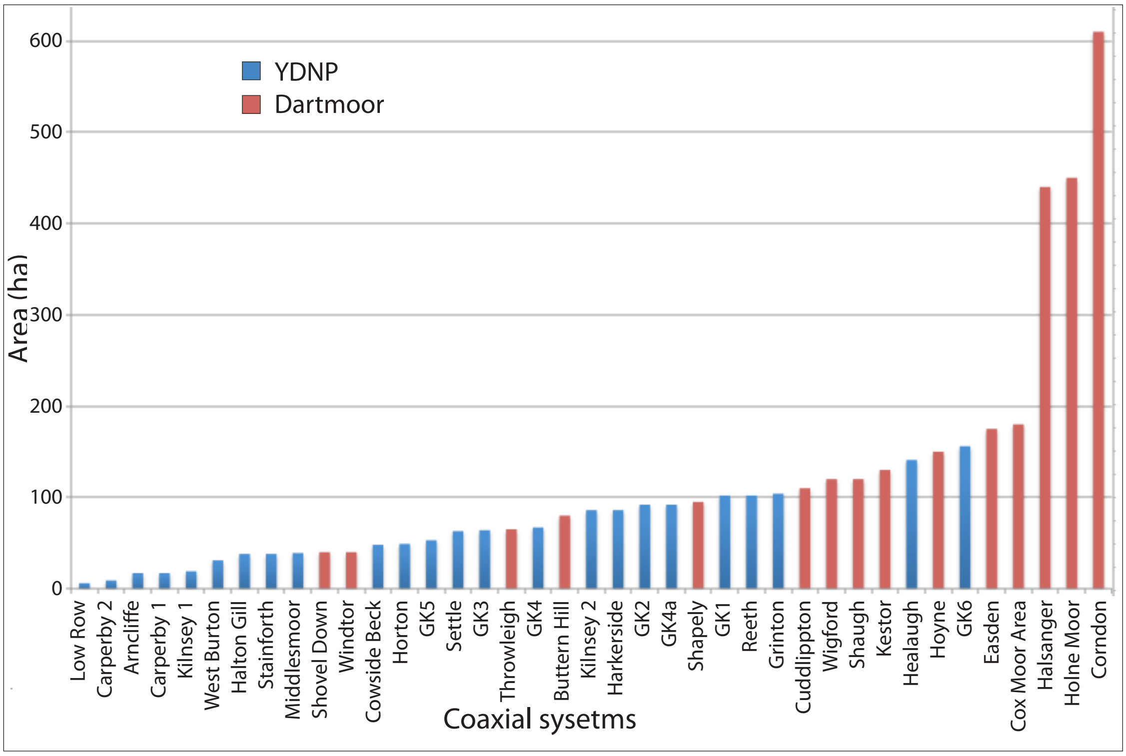


Fig. 6.16 Area of the individual systems in the Yorkshire Dales National Park and 15 coaxial systems on Dartmoor. (Dartmoor data from Wickstead 2008b: 62, fig. 3.13.)

As demonstrated in the previous chapter (Section 5.3.2), the known coaxial systems of the Dales cover a total of almost 1500ha within the National Park. This includes a variety of individual dimensions, with most systems of the order of tens of hectares; the largest system, Grassington-Kettlewell 6, covers around 156ha. It is difficult to know without (and even with) further investigation, whether all 24 of the known coaxial field systems were at the same, or roughly similar, stages in their lives in order to make direct comparisons: a number of prototypical systems, or systems that were not fully chronologically developed on abandonment may partly explain the range of sizes present in fig. 6.16. Some of the smaller areas may have formed satellite or annex systems. The range of areas measured also raises questions of how the systems developed in space, whether the full extent was marked out prior to stone boundary construction, whether the space was carved up from the middle outward or expanded sideways from one end along the valley, and the extent to which previously unmarked hefting territories influenced decisions. Although Fleming suggests that systems should have an area greater than 100ha to qualify for the description of 'coaxial' (1987: 188), this seems a somewhat arbitrary figure: the majority of the Dales systems are smaller than this yet appear to form cohesive systems. Indeed, several of the Swaledale systems that Fleming worked on are only just 100ha in area and in some cases (such as Harkerside 86ha) are smaller (as measured by this study).

By way of comparison, fig. 6.16 also gives an indication of the approximate area of 15 systems on Dartmoor. It is clear that, on the whole, the systems of the Dales are laid out on a considerably smaller scale than those of Dartmoor, although this may be a question of preservation and less intensive study. Approximately half of the fifteen Dartmoor systems measure between 100 and 200 ha, with three that are distinctly larger: Comdon Down system covers over 600ha, Holne Moor c.450ha and Halsanger system roughly 425ha. This is, however, a similar pattern to the systems of the Dales, which also have two systems, namely Grassington-Kettlewell 6 (156ha) and Healaugh (141ha) that are noticeably larger than the others, particularly those in Littondale, Ribblesdale and Wensleydale. Given that the Yorkshire Dales National Park is roughly twice the size of that of Dartmoor, the percentage of land covered by coaxial field systems is of the order of at least 3.5 times less (Wickstead gives data for the area of the 15 main systems on Dartmoor (2805ha), which cover 2.94% of the national park *i.e.* an underestimate of the total; the known examples in the Yorkshire Dales cover 1473ha i.e. 0.83% of the park). This comparison has implications for the comparative populations of the two areas; a smaller, sparser population in Yorkshire would suggest that the boundaries have little to do with pressure for land, therefore any territorial competition must presumably be a consequence of socially generated forces.

Fleming explains the Dartmoor systems as 'territories', with their size based on drainage patterns (Fleming 1978; 2008: 52-73). Each river valley is interpreted as containing one 'territory', comprising a parallel reave system of enclosed land as well as, above this, pasture and rough grazing demarcated by the watershed reaves. According to this interpretation, the largest of these ‘territories’, most easily identified on the southern and eastern parts of the moor, is the Rippon Tor system; incorporating both the enclosed and unenclosed land as well as modern hedges on lower land that are orientated such that they suggest fossilized reave layout, it is estimated that the system covers around 4500ha (Fleming 2008: 65) (note that this is a different criteria for measurement to that employed by Wickstead used in fig. 6.16). Taking the same, less conservative, approach to the measurement of area, it is calculated here that the largest system in the Dales, Grassington-Kettlewell 6 (156ha) would cover roughly 1000ha, incorporating associated moorland grazing and valley bottom land as well as the enclosed coaxial system itself. Harkerside (86ha) could have covered over 800ha, Grassington-Kettlewell 1 (102ha) and 2 (92ha) some 600ha each and Horton (49ha) up to 700ha. Thus it is evident that the Dales systems are still operating at a reduced scale compared with Dartmoor. It is certainly possible that the land above the terminal boundary/scar in systems in the Dales was used as pasture - whether common or not is impossible to say at this stage as any upper contour or watershed territorial boundary would be invisible in heather without determined survey or have succumbed to the encroachment of peat on the higher, less permeable grit geology. It is less plausible that one coaxial system is associated with each dale. Given (Chapter 4) that there are what appear to be several distinct systems, with distinct alignments, within each valley, the arrangement appears to be more complex. While not necessarily in use contemporaneously, the valleys, which are on a much larger scale than those of Dartmoor, do not appear dominated by any individual discrete system. It is not clear whether the systems in each valley were controlled or used by members of the same or unrelated communities.

6.2.5 ‘Density’ of boundaries

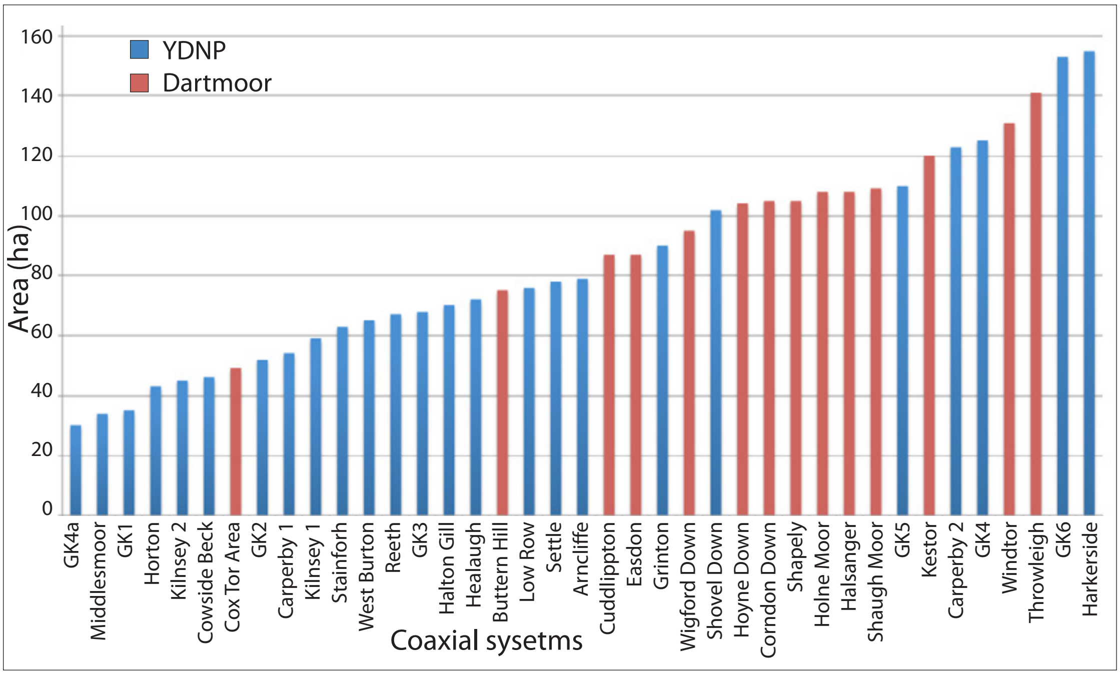


Fig. 6.17 Length of boundary per hectare, as measured for systems in the Yorkshire Dales and 15 systems on Dartmoor. (Dartmoor data from Wickstead 2008b: 62, fig. 3.13.)

The Dales demonstrate differential densities (that is, length of boundary per hectare) between systems (Section 5.3.3), while also demonstrating a wide range of densities (fig. 6.17). The densest, Harkerside, measured approximately 155 metres per hectare compared with 141 mha^{-1} at Throwleigh Common, the densest measured system on Dartmoor; the least dense of the Dales systems (excluding Grassington-Kettlewell 4a, which is particularly fragmentary), Middlesmoor Pasture, measured 34 mha^{-1}, while the equivalent on Dartmoor was the Cox Tor Area, measuring 49 mha^{-1}. While the most dense systems in the Dales were five times the density of the least dense systems, the most dense systems on Dartmoor were three times as dense as the least dense systems there. According to classical theories of property, the pressure of long term land scarcity will cause a landscape to become involuted and intricately divided up, exhibiting land division that is highly and evenly dense across all suitable areas (see Wickstead 2008b: 51). The range of measurements noted demonstrates that the Dales systems are not divided equally densely; this also applies to the Dartmoor systems (Wickstead 2008b: 61-63). The origins of such variation in density are difficult to determine from the extant boundaries, other than to assume that there may be local reasons related to factors such as population fluctuations, varied land productivity or immediate topography. Other coaxial landscapes also appear to demonstrate this intermittent, patchy quality. The field systems recorded by the English Heritage field survey of the Salisbury Plain Training Area, for example, show some local variation; while less pronounced than on Dartmoor, it is most apparent between systems at Figheldean and Maddington (fig. 6.18) (MacOmish *et al*. 2002: 55).

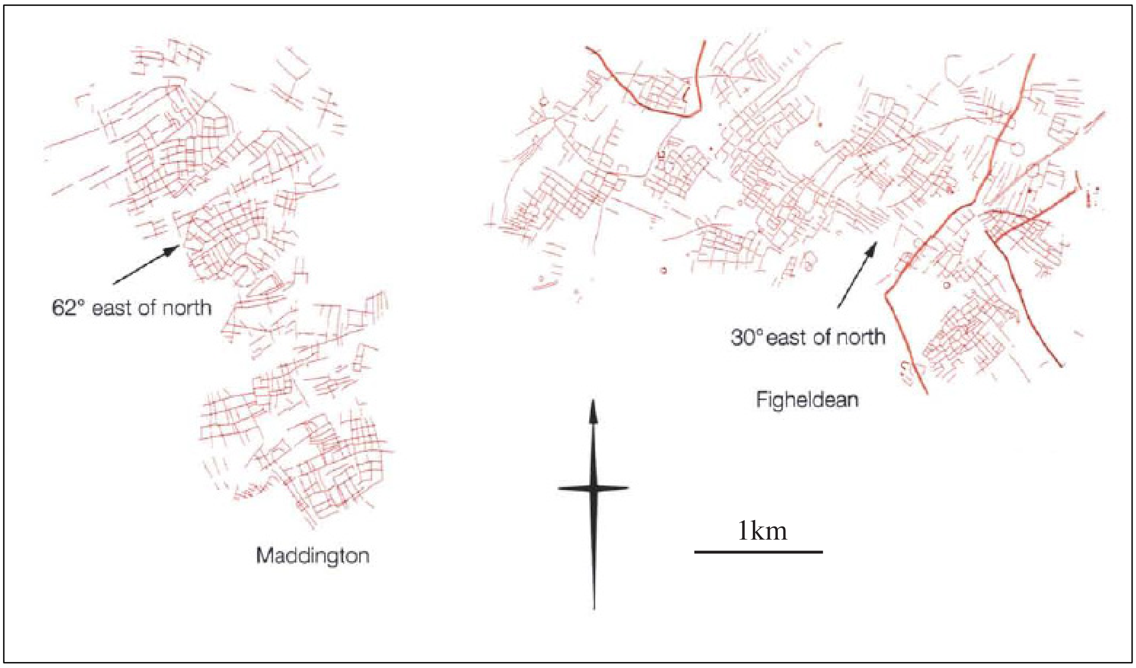


Fig. 6.18 Field systems on Salisbury Plain Training Area. Note the variation in density of boundaries between and within systems. (After McOmish et al. 2002: 55, fig. 3.4.)

Wickstead expanded her analysis of density by looking at buildings per hectare, which, on Dartmoor, tend to cluster where reaves are densest, referred to by Fleming as ‘neighbourhood groups’ (Wickstead 2008b: 63). This would be an interesting analysis to conduct on buildings and boundaries in the Dales, but will have to wait until further work has been carried out to identify and date the settlement evidence.

6.2.6 Frequency of boundaries

The frequency of the axial boundaries in the Dales, that is, the number of axials per unit length, or the distance between the axial boundaries, was expressed graphically (see Section 5.3.4). This process was sufficient to show that, while the majority of coaxial strips are between approximately 30 and 60m in width, there is a large degree of variation within systems, and an even larger degree overall. In particular, distances between axials are larger in Swaledale and there is a larger overall range. At High Park, Jecock identified differences of between *c.*90 and 120m between axial boundaries, suggesting a similar degree of variation, if larger coaxial strips than the majority of those within the National Park.

The corresponding data available for Iron Age strip fields in Västergötland, Sweden, is such that Widgren has been able to apply metrological analysis to conclude that fields were not haphazardly divided, but relied on a measuring technique of some kind for parcellation (Widgren 1998). Using the same method, Wickstead outlined the distribution of errors in measurements and tested the degree to which members of measurement populations are multiples of a basic quantum for enclosures on Dartmoor. Having examined eight coaxial systems, she concludes that there is no overall quantum, but that the Shaugh Moor and Shovel Down systems are probably based around quanta of 28.7m and 24.5m respectively (Wickstead 2008b: 136). However, her emphasis is on the expectation of finding a measurable quantity, which may not necessarily be an appropriate assumption.

6.2.7 Orientation and aspect

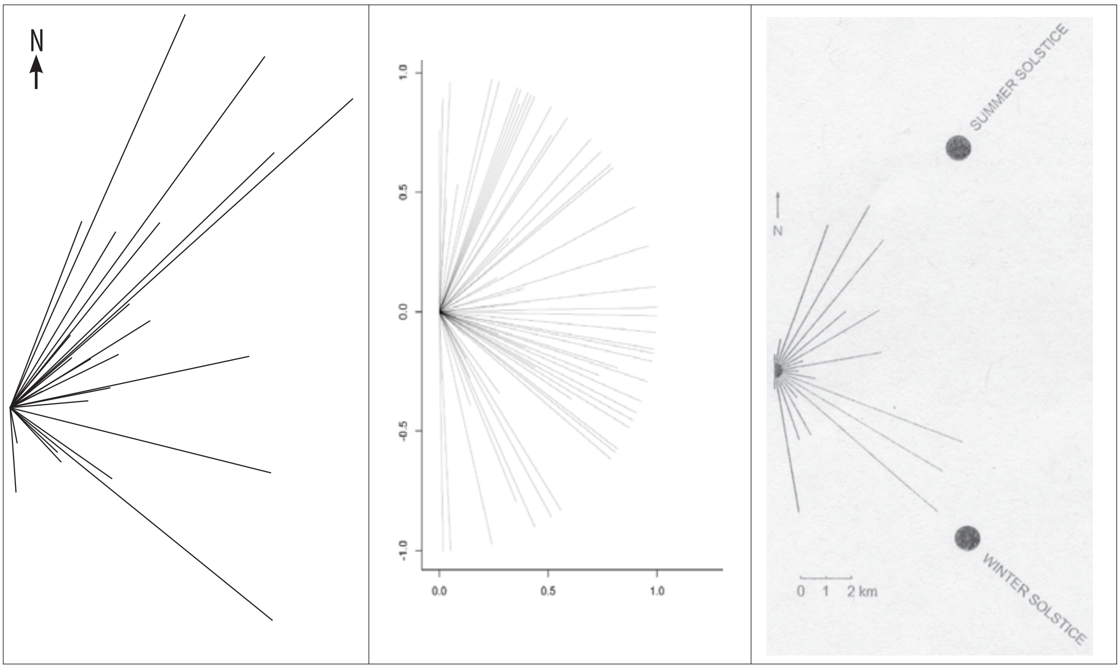


Fig. 6.19 Comparison of ray diagrams showing the orientation of field system axes. Left: each ray represents the modal direction and relative length value of an individual coaxial system in the Dales. Centre: rays showing orientation (direction and strength) of the field systems studied by the Englaid Project, suggesting a slight bias towards the approximate compass bearings of 100-120º and 10-30º. (Reproduced from Green 2016.) Bottom right: rays illustrating the orientation of field systems in the Thames Valley, demonstrating bias towards the midwinter sunrise. (Reproduced from Yates 2012: 290, fig. 28.1.)

Measured from the ray diagram of modal boundary direction (fig. 5.3.4), the orientation of field systems in the Yorkshire Dales cluster broadly around the points of the solar arc, showing bias towards the summer solstice sunrise/winter solstice sunset (northeast-southwest) and the winter solstice sunrise/summer solstice sunset (the opposite directions have been equated as the boundaries do not show any directional preference between up and down slope). The reasons for the specific distributions are likely to be complex, but include topographic variation as well as aspect and slope, which will significantly complicate the local situation, potentially altering the influence of the solar arc. The aspect of the land would be of particular importance, given the depth of the valleys and height of the interfluves between them, whether the land was selected for practical advantages - north-facing slopes appear to be less favoured - or less prosaic reasons. The degree of variation seen around the angles representing these solar events could be explained by the steep topography of the region producing a relatively close horizon, which has a knock on impact on the point at which the rising/setting sun will be visible from any given point, yet fig. 6.18 indicates that other regions (topography unknown) also demonstrate such variation.

Having compiled and measured, using ruler and compass, the orientation of coaxial boundaries across southern England, Yates has also noted that the most prevalent axis (i.e. the longest length of ditches at one bearing point) of the lowland boundaries lies towards the southeast, and, in particular, along the bearing of 130º, with the return transverse axis running along 50º. He argues that it is not coincidental that the prevalent axis corresponds with the alignment of the mid-winter solstice sunrise (fig. 6.19), with the darkest time of year being taken up by 'winter work' on the farm, including the laying out and construction of at least some of the boundaries (Yates 2012). The possibility that the alignment is in fact following the mid-summer solstice sunset (rather than mid-winter sunrise), which would follow the same alignment on a 1-180º diagram, is not discussed. Yates suggests that the upland boundaries also appear to be influenced to some extent by the solar arc, with the dominant axes of coaxial layouts on Salisbury Plain running northwest-southeast and southwest-northeast (McOmish *et al*. 2002: 55; Green 2013) and those of the Marlborough Downs running similarly at 134º and 44º (Fowler 2000: 25); the relatively flat topography of these areas emphasizes the presumably deliberate use of these orientations. Fleming's diagrammatic map of the Dartmoor reaves has also been used to calculate that, despite the apparently outward-facing terrain, a predominance of boundaries exist on the 30-50º and 120-150º alignments (Yates 2012: 292). Investigating the axes of some 40 field systems across England, the Englaid Project has detected a bias towards the alignments of 100-120º and 10-30º (fig. 6.18), which appears common enough that it is possible to conclude that "something is going on" (Green 2016a), and, although the nature of that 'something' is yet to be determined it may be related to solstitial activity (Green 2016b).

On the ground as well as on the contour map, the orientation of the boundaries perpendicular to the contour lines is striking: this can be noticed in virtually all of the Yorkshire Dales examples (see Section 4.4-4.8) as, by extension, can the positioning of the axial boundaries at right angles to the rivers. This is also a feature of the axial reaves on Dartmoor (Fleming 2008: figs. 23-30), as well as those along the edge of the fenland in the east of England, where Pryor has recorded droveways and boundaries running down to the wetter ground (Pryor 2006: 79). This arrangement bears similarities to later, medieval land divisions that are traditionally arranged to ensure that owners/tenants/parishes have access to (or are lumbered with) a portion of the different resources and environments that are present in the various zones as the land rises away from the river (fig. 6.20). This differential would be more pronounced in the upland area of the Dales. As it is noticeable that the later valley bottom boundaries and lynchets often share their alignment with the axial boundaries, targeted excavation of boundaries on the valley floor would be of interest in order to illuminate any relationship between the various chronological phases as well as investigate whether the coaxial systems originally extended their influence downslope of the steepest portion of the valley sides, on to the flood plain. Perry Oaks proves an exception to this pattern, and, separated from the River Colne by aggregated fields and what the excavators interpret as a plot of common land, runs parallel to the river and contours, although its transverse boundaries therefore run perpendicular to the contours. In addition to the practical and political necessities for sharing resources, Wickstead has suggested that in theory such enclosure would select for improvements in the quality of fodder available as contained stock would eat all that was available rather than leaving the poorer quality out of choice (Wickstead 2008b: 82).

Fig. 6.20 Medieval boundaries and lynchets at right angles to the River Wharfe, Kettlewell, Wharfedale. Photo: author.

6.2.8 Archaeological Context

An assemblage of worked flints from the area between Grassington and Kettlewell (Cherry 1998; Raistrick 1937) and the fellsides of Swaledale (Fleming 2010: 126-7) among other areas (these areas have been subject to more systematic search), suggest that the land of the Dales was in use during the late Mesolithic, Neolithic and early Bronze Age. This is supported by the presence, less than 1km away from some of the Wharfedale coaxial systems, at Yarnbury and Threshfield, of henge monuments (MYD4364, MYD57712). Later artefacts, frequently under recorded and often lost, having come predominantly from antiquarian barrow excavations, hardly support an interpretation of either how or why the field systems were developed, with the possible exception of an item interpreted as an Iron Age sickle (Skipton Museum: SKIPM:A107), which may indicate cereal or hay production. The presence of barrows in itself reinforces the interpretation of use of these areas during the earlier Bronze Age and later, and indeed may indicate that encroachment of coaxial systems on to existing grazing/grassland, which would fit with the lack of evidence for prior settlement to the Middle Bronze Age coaxial layout at Perry Oaks (Lewis *et al.* 2010: 139). There is no obvious relationship between the barrows and the field systems, with one exception (Section 5.4.1), in contrast to the findings of Løvschal in Denmark, where late Bronze Age inter-organisational linear landscape components were often associated with barrow corridors (Løvschal 2015). This may hint at a 'clean sweep' approach to land division by the builders of the Yorkshire boundaries, exhibiting a lack of regard for previous landuse patterns. Alternatively, the fact that they did not 'disturb' the barrows by running boundaries up to them may have been deliberate (see Section 5.4.1). Fleming has linked 'early' monuments such as stone rows with coaxial systems on Dartmoor, through their often-common location and alignment (Fleming 2008: 122, fig. 61) as well as their morphology and potential ceremonial use of linear form running up hill (Fleming 2008: 197). While no stone rows are currently known in the Yorkshire Dales National Park, the recent interpretation of geophysical data as containing such features within the area of Grassignton-Kettlewell 6 system (M. Saunders, pers. comm.) may make further investigation fruitful. Further excavation of Dales coaxials is undoubtedly needed, although the limestone geology is such that, say, the wealth of artefacts, including bark containers (Lewis *et al.* 2010: 197) and wooden objects (Lewis *et al*. 2010: 185), and rich stratigraphy recovered from the waterlogged waterholes and wells of Perry Oaks, cannot be expected.

6.2.9 Land use

There is little explicit evidence for the contents of late prehistoric fields in the Dales, or indeed, on most upland sites. Although pollen data from Ellerton Moor included a low level of cereal pollen present throughout later prehistory (Fleming & Laurie 1993: 4), terrain and elevation, which have a direct affect on growing season, suggest pastoral activity may have been more successful than arable cultivation. It is possible that due to climatic variation, at times the upper elevation limit for successfully cultivating cereals could have been as low as 110m aOD before 150BC (and around 200-250m aOD after this) (Nevell 1999: 17). It is heavily documented (Lancaster 1915) that large-scale sheep farming operations were carried out in parts of the Dales by monastic houses during the Middle Ages, yet comparatively little obvious evidence remains in the landscape, perhaps indicating that late prehistoric stock keeping may also require closer investigation to detect.

Conversely, the lowland coaxial landscapes often demonstrate compelling indications for pastoral priorities. Structural indicators include the presence of droveways for moving animals through the landscape (for example, six double-ditched trackways separated what has been interpreted as five farmsteads in the Middle Bronze Age coaxial zone of Perry Oaks (Lewis *et al*. 2010: 145, fig. 3.8) and the axis of the fen-edge landscape centred on droveways (Pryor 2006: 94)) and stock control features, including what Pryor terms ‘community stockyards’ (Pryor 2006: 128), funnels and corner entrances to fields as well as waterholes (such as the frequent examples at Perry Oaks). More ephemeral evidence includes cattle hoof prints, which have been found in large numbers at Fengate (Pryor 2006: 97, fig. 46) and prints of cattle, sheep and horses from Saddlesborough Reave, Dartmoor (Balaam 1982: 272). As has been the case in the lowlands, excavation (or at least much more detailed earthwork analysis) is required in the Yorkshire Dales to investigate more closely the possibility that droveways such as those visible in the Halton Gill or Grassington-Kettlewell 3 systems were in use during the later prehistoric period or were contemporary with the coaxial field systems. While they tend to align with the coaxials, most will have been in use into the medieval period and later and some systems, such as Cowside Beck, are associated with complex braided holloways on similar alignments, making distinction difficult from surface evidence alone.

Less overt, but persuasive, is the presence of fungal spore data and pollen indicative of grazing animals and species rich grassland at Shovel Down on Dartmoor (Fyfe *et al*. 2008). A recurring theme among the pollen evidence from both upland and lowland sites is a general lack of cereal pollen, even allowing for poor survival levels. Pryor suggests that cereals were grown in small garden plots in order to overcome damage from weather and animals

(Pryor 2006: 82), and a mixed farming regime may have proved advantageous. Phosphate studies on sub-surface coaxially-contained soils at Holne Moor, Dartmoor, suggested pastoral land use, particularly the keeping of sheep; furthermore, these elevated phosphate levels were higher than those from surrounding Medieval enclosures, suggesting more intensive prehistoric grazing. On the other hand, two further coaxial fields tested showed no clear positive or negative phosphate anomalies (see Wickstead 2008: 49).

6.3 Conclusion

Judging from the spread of known coaxial systems across Britain, the coaxial landscapes of the Yorkshire Dales did not emerge in a social or cultural vacuum. Their analysis and interpretation can now also be informed by those systems around them, several of which have seen relatively intensive archaeological investigation. The extensiveness of such systems in upland areas suggests that this land could not be considered ‘marginal’ in later prehistory in the same way as it is today. However, the additional occurrence of coaxial systems across wide areas of lowland Britain, suggests that it was the specific pattern of boundaries as much as the location that was of central importance to their existence. Despite the many similarities - in construction, morphology and alignment, for instance - between the systems of the Yorkshire Dales and others, the Yorkshire boundaries also differ - in terms of size, morphology and density - both with systems elsewhere and among themselves (which may not be surprising, given that the landscape of the limestone massif is unique in the UK). Given the unknown nature of the relationships between regional systems (and their creators), it is difficult to extend conclusions between them without making unfounded assumptions, but it is fair to say that while ongoing work on other systems may raise more questions than answers for the Yorkshire Dales systems, it also demonstrates potential for the future.

7. Discussion

...A landscape fossilized,
Its stone wall patternings
Repeated before our eyes
In the stone walls of Mayo...

From 'Belderg' by Seamus Heaney

Heaney's well-known poem describing the 'stone wall patternings' of Céide Fields might equally apply to the stone walls of Yorkshire. This stanza gives the impression of the landscape-scale of the remains; it also describes the landscape as “fossilized” - while this may be true now, there was a time when it was alive, functioning and dynamic, and home to a population of people and animals. It may be difficult for the passing hill walker to appreciate the effort that once went into constructing and maintaining the boundaries in the Dales, but, having recognized them in the landscape, they raise a profusion of questions about their building.

7.1 Use of the landscape

The analysis presented here, based on the first detailed synthesis of data relating to these landscapes, enables us to identify some common characteristics of the coaxial field systems of the Yorkshire Dales. What is most striking is the extent to which the topography and geomorphology appears to be employed as part of the systems, which is not surprising, considering the dominant and, at times, harsh nature of the environment. This is not to say that the landscape predisposes its inhabitants to any particular approach, rather that the evidence suggests that the population responded to their surroundings in a reflexive manner. This is a typical approach in many rural cases, given the dependency of societies on their natural resources. To use a modern Malagasy example, the landscape features and natural resources - and therefore traditional livelihoods - are central to the identities of the island’s ethnic groups and are reflected in their names, which include “the people of the thorns” (the *Antandroy*), “the people of the forests” (the *Tanala*), “the people of the swamps” (the *Sihanaka*), “the people of the sand” (the *Antaifasy*), “the people of the long valleys” (the *Sakalava*) and “the people of the islands" (the *Antanosy*). More locally, within the Anosy region, rural inhabitants describe each other using a location-based vocabulary: the *taboitry* (‘people from the mountains’), the *tambany vohitry* (‘people from beneath the mountains’), the *tandriaky* (‘people from the sea’) (Mbola Sylvestre pers. comm.). These descriptive names show how, in rural areas, people identify with the local geography and describe other groups in similar terms - terms that also reinforce territorial ideas. This awareness is crucial to their way of life and sometimes lost in the modern urban approach. In many respects, medieval and later populations have also developed solutions that take into account the extreme environment, including the difficulties and advantages, of the landscape of the Yorkshire Dales: villages such as Starbotton and Buckden (Wharfedale) are perched on alluvial fans above the wettest parts of the valley floor and boundaries run at right angles to the river to divide up resources fairly. It is worth remembering that those who worked the coaxial systems would have known the landscape much more closely than any modern observer save the most dedicated Dales farmers.

7.1.1 Use of natural terrain

The coaxial systems of the southern Dales are unlike most other systems in the country in that the known archaeology consists of parallel lines with very few built transverse boundaries. It is unlikely that this is a matter of differential preservation, given the survival of axial boundaries in the same areas, and the fact that even robbed-out walls tend to leave a trace on aerial photographs. After examining the range of coaxial systems known in the Yorkshire Dales, it is possible to build on Horne & MacLeod’s 1995 observation that three of the Wharfedale systems run across limestone terraces and scars, perhaps consciously utilized as transverse dividers (Horne & MacLeod 1995: 35), and postulate that the presence of these landscape features replaced the need for transverse and terminal boundaries across the region. Three quarters of those examined have natural potential transverse boundaries (the axial boundaries run across scars at ninety degrees), or appear to stop at an upper or lower ‘terminal scar’ or significant change of gradient (see Section 5.4). Exceptions to this include Grassington-Kettlewell 3 and 5, neither of which has artificial transverse/terminal divisions nor incorporates pronounced terracing. As discussed above, Grassington-Kettlewell system 6 is anomalous due to the frequency of transverse boundaries, the majority of which would seem to arise from Romano-British reuse, while Grassington-Kettlewell system 4 and Kilnsey 2 both demonstrate built transverse boundaries as well as the utilization of transverse limestone scars. In a sense these built boundaries emulate the scars in locations where the latter are not conveniently located. In a nod to Fleming’s original definition of coaxiality, Yates has described coaxial systems as “inherently inflexible and oblivious to terrain” with “unswerving boundaries [that] ignore potential topographical obstructions” (Yates 2012: 289): the other side of this coin is the deliberate incorporation of these ‘obstructions’ into the field systems, by running over them precisely because they were there. It is also possible that our interpretation has been coloured by the familiarity of the medieval boundaries - perhaps the landscape was interpreted ‘the other way round’ with the builders viewing the horizontal parallel scars as the ready-made axial boundaries, and the artificial divisions they built serving as transverse demarcations, although the dominant axis does seem in many cases to run up and down the slope rather than along it. Rather than disconnecting natural and artificial features, it is likely that there was somewhat of an overlap between the two, especially given that the built boundaries were essentially curated forms of the stone that formed the natural divisions.

In contrast, the systems of Swaledale, including those of Marrick and Skelton Moors just outside the National Park, are not located on such defiantly terraced hillsides as those further south. The geology of the systems is predominantly limestone, but sand- and mudstones and till contribute to a greater degree, with fewer exposed scars than the Craven area. Perhaps in response to this situation, these systems appear to contain more built transverse and terminal boundaries and are more ‘densely’ organized than other systems. The individual axial boundaries are typically longer than those in the southern dales, presumably because they are not punctuated by scars and terraces, and it may be for this reason that they are noticeably more sinuous and less straight than those of, say, Wharfedale or Littondale - to judge from evidence from Dartmoor (Fleming 2008; Johnston 2005), it is possible that this sinuosity indicates that they were built in sections by separate work gangs, whereas the builders of Wharfedale worked on a section at a time. The boundaries of Swaledale are thus perhaps more reminiscent of those on Dartmoor than are those of the southern Dales.

7.1.2 Orientation and alignment

The axes of the built boundaries directly oppose the contour lines in almost all cases (the exception being the Reeth system, where the axes bridge a spur). They are also at right angles to the limestone scars that substitute for transverse boundaries. In this respect, the orientation of the boundaries and the aspect of the site are determined by that of the dale side on which they sit. It appears, however, that these sites may have been chosen with the solar arc in mind: there is a bias in the distribution of systems towards the mid-summer sunrise/mid-winter sunset (being straight, the axial boundaries give no indication of favoured up/downslope directionality), with a minority tending towards the mid-winter sunrise/mid-summer sunset (see Section 5.4.2). The ray diagrams of fig. 5.34 demonstrate some variation around the specific points of the solar events, probably explained by the generally close horizon, however the bias is apparent in spite of the extreme local topography. This may introduce a conceptual element into any pragmatic decisions upon which the establishment of a system were based. For people living in such direct contact with their environment, an awareness of the solar calendar, changing seasons, day length and weather would be crucial, with the relative position of the sun underpinning agricultural planning, economic success and social customs. Practices of solar and lunar observation have been deciphered from the alignments and situations of many early prehistoric monuments (see, for example, Higginbottom *et al.* 2015; Gaffney *et al*. 2013), and it has been postulated that this can be seen in the later prehistoric domestic sphere (Parker Pearson & Richards 1994; Parker Pearson 1996; Oswald 1997), so this would not have been a novel idea. Nor would it have been unique to the Dales as this alignment corresponds with that of other coaxial field systems across Britain (Section 6.2.7) (Yates 2012; Green 2016a, 2016b), thus raising questions as to the spread and acceptance of such deliberate notions across distances of space and, possibly, time. Even in modern times we are aware of the impact of a sunny day on productivity and mood. If spiritual as well as motivational thinking was linked with the rising and setting sun and associated seasonal changes, the upland sites of the Dales, located to avoid the shade of the valley bottoms, could have been situations of choice for the boundary builders.

7.2 Less visible aspects

Besides the visible and functional components of coaxial construction and use, it must be borne in mind that many aspects of the field systems were less tangible or quantifiable, and less discernible to the archaeologist. Having given 'rational' explanations for the quantity and quality of land that would be cleared for agriculture (based on the amount an individual could manage to cultivate, and the quality of the soil respectively), one Malagasy village elder then continued to demonstrate both formal and less formal examples of less visible elements in the process:

> Before you clear land you consult an elder who knows auspicious days, and before you plant. The reason people do this is that he will be safe doing it and will not have any accidents. Before planting the crops it is so that the crops will thrive… [he then offered an extremely complex explanation of the means by which elders calculate 'auspicious' days]… It is up to you, if you want to bring some moonshine before you clear it. You pray to your creator and ancestors for nothing bad to happen. Some people believe this. If you clear land for house building you have to do that and everybody here does it. (Sosony, pers. comm.)

It is highly likely that the original inhabitants of the coaxial landscapes also reinforced their physical landscape with supernatural elements, whether this applied to processes (as above) or to the imbuing of prominent physical features with meaning, or to both. Such anomalous or ‘special’ physical features could include the large sinkhole on which the long boundary of Grassington-Kettlewell system 3 is aligned, the smaller sinkhole marking the end of a boundary of the possible coaxial system at Appletreewick (Cardwell *et al*. 1990: 4), the numerous caves in the vicinity of the field systems or the glacial erratics located within the Stainforth coaxial system - the largest of which is sufficiently prominent to have acquired the modern name Samson’s Toe. Alongside the physical landscape, an extra dimension would have been present in the form, to borrow Pryor's phrase, of a 'landscape of the mind' (Pryor 2006: 70), formed from folk knowledge, oral tradition and beliefs in the ancestors. Of great relevance here is the possibility that the physical and mental landscapes were combined, to form social mnemonics as demonstrated by the case study of the occupants of the Tari Basin, Papua New Guinea, and their complex of drainage ditches. These systems were associated with known individuals and resulted in landscape-scale genealogies representative of over 500 years of kinship relationships, which serve to control social ties and land entitlements into the present (see Gosden & Lock 1998: 5). Although the inhabitants of the Tari Basin constructed drainage ditches rather than field walls, the linear form of both monuments suggest the possibility of close parallels in usage. Gosden & Lock differentiate between genealogical histories, or those referring to known or ‘real’ ancestors and events, and mythical histories, those where a more nebulous past is evoked, although in reality this differentiation is not a binary one but extends over a spectrum (Gosden & Lock 1998). This distinction does not just apply to prehistoric Britain, but, for example, underpinned structures of Early Medieval kingship, where human genealogy blurred into divine myth in an attempt to fortify royal power: for example, Bede describes how the first kings of Kent, Hengist and Horsa (themselves semi-mythical), were the sons of Wictgils, the son of Witta, the son of Wecta, the son of the god Woden, “from whose stock sprang the royal house of many provinces” (Farmer 1990: 63); the *Anglo-Saxon Chronicle* also documents some of these examples, including the pedigree of the Northumbrian royal family (via Ida, Eoppa, Esa, Ingui, Angenwit, Aloc, Benoc, Brand, and Bældæg to Woden) and that of the West Saxons (via Cynric, Cerdic, Elesa, Esla, Gewis, Wig, Freawine, Frithugar, Brand, and Bældæg to Woden) (Swanton 2000: 16). The expansive nature of the field systems might suggest that they invited representations of mythical as well as ‘real’ genealogical histories on size grounds as purely ‘real’ genealogical lines would be more limited in scope by human memory. Moreover, the regular work required to maintain the boundaries and the fields may have served to strengthen ties, both to the rest of the community and to the past, through the generation of communal pride in creation, creative and physical satisfaction, the shared experience of strenuous work or the possible emergence of new sources of authority (Giles 2012: 52; Chadwick 2013: 25). Gosden's suggestion (Gosden 2013: 115) that there may be a link between field systems and genealogical remembrance creates an image of extended family members working together in bereavement to create a new field/memorial that would continue to support the remaining family. The dedication of land as memorials has, of course, continued in a simpler format in present day Western society, with nineteenth- and twentieth-century examples such as 'Jonathan's Orchard' and 'Sinclair's field', celebrating local people - the child who died and the industrialist who donated land for recreational purposes - with their names recalled in everyday usage (examples from Otley Chevin, West Yorkshire: SE19956 44528, SE19999 44584).

It is difficult to know how the builders of the coaxial systems approached the *in situ* barrows and burial cairns that pepper the hillsides, presumably remnants from the modification of the landscape by earlier Bronze Age generations. It is recorded from antiquarian excavation that several were reused for burial in the Iron Age (e.g. Speight 1894), suggesting they were still relevant centuries after the deaths of their original occupants, either directly - in their maintained capacity as burial monuments - or because they attained a new meaning, accruing value with age. They presumably served as mnemonic devices, not just assisting recall of a new genealogy with associated social details of the new occupant, but also placing the new occupant as part of the mythical history of the society, reinforcing the gravitas of the new burial with connotations of links with the ancient, permanent and prominent feature in the landscape. While barrows are distributed widely across the Yorkshire Dales National Park and the coaxial field systems fall within their distribution, there is limited correlation at a local level. It is intriguing that one (reused) burial mound (MYD4025) appears to be the focus for the alignment of two axial boundaries (from systems Grassington-Kettlewell 4a and 5) and a conspicuous (non-coaxial) boundary. This was presumably a conscious alignment on the original barrow, although it is not clear whether the Iron Age reuse of the earlier burial structure pre- or post-dates, or is contemporary with, the aligned boundaries. Other systems, primarily in Wharfedale, contain funerary monuments, none of which coincide with boundary alignments. It may be that the boundary builders were deliberately ignoring and paying no attention to these features, projecting a blank canvas on the used landscape and encroaching on grassland/grazing previously maintained as open land due to the presence of the burial monuments and any related associations with the ancestors; it could also be, particularly considering the later prehistoric recognition of the barrows, that they were deliberately 'left in peace' in so far as, although some boundaries pass close by, the barrows themselves are not actually disturbed and access and movement within the coaxial systems remain unknown. The finding of four pits containing the cremated remains of individual human adults alongside a field boundary at Gwithian, Cornwall (Nowakowski 2009: 121), - invisible without excavation - may illustrate an important ideological link between the land and the ancestors, with the latter not only owning but physically making up the former (Williams 2010: 168). Nevertheless, finding further evidence to support such statements in the Dales is challenging, even with the possibility of excavation.

The placement of burials in boundaries serves to reinforce the role of boundaries as liminal places, demarcating the threshold between the 'controlled', 'known' environment and the 'other' outside world, whether on the scale of the community vs the 'wild' world, or the individual family alongside a neighbour. This appears to be a common theme throughout the past. Reynolds' work, for example, has highlighted the frequency with which Anglo-Saxon 'deviant' burials are located outside the community, that is, on hundred, parish or estate boundaries (Reynolds 2003), while Sauer provides the example of an Anglo-Saxon burial (decapitated after death) in a boundary ditch of unknown function and probable Iron Age date (Sauer 2005). Boundaries take on a dual role in controlling access: keeping animals in or out in a practical sense - protecting a hay crop or deterring predators – as well as differentiating human access (depending on the permeability of the boundary), demarcating ownership and emphasizing social differences. The physical framing of an area through the parcelling of land by linear elements at whatever scale, indicates the presence of social rules that the inhabitants necessarily understand and conform to (Løvschal & Holst 2015; Løvschal 2014). The boundaries served to clarify and define both spatial and potential social differences, while also helping to alleviate dispute (Giles 2012: 54) through the manifestation of such social rules - although the human remains found in a boundary at Tormarton, Gloucestershire, may illustrate the other extreme, having been interpreted as a result of an escalating conflict during boundary construction (Osgood 2005).

Through a combination of artificial boundaries and the utilization of natural features, the later prehistoric landscape of the Dales was thus divided into the gridded pattern reminiscent of more well known coaxial systems. Some systems, such as Grassington-Kettlewell 1, where axials continue between the horizontal scars, appear particularly regular. Yates has argued that gridding such as this (albeit delineated entirely through artificial boundaries) in the Thames Valley in itself is symbolic of a new, intensive, efficient way of farming. He picks up on Krauss' suggestion that a coaxial grid is inherently anti-natural, requiring the builders to 'turn their backs on nature', with grids perhaps signaling a new intent to "declare the modernity of the occupiers" (Yates 2007: 134-135). While this may have been the case on the alluvial lowlands, with few straight lines occurring naturally in the landscape, the shock of the new may have been diluted somewhat among the geometric clints and grykes of limestone country where (almost) straight lines and right angles had been prevalent for millennia. Even if the impression was one of working *with* nature in this respect, the scale and persistence of the coaxial boundaries' demands for conformity must have had an impact, even if this was not necessarily, given their probable incremental formation, one of sweeping revolution. While the evidence for pre-coaxial land division is slight, the repetition of both the substantial walls and the permanently enclosed spaces of the plots appears to have been unprecedented in the Dales.

It is a well-known human trait to try to make order out of chaos, consciously and unconsciously seeking to recognize patterns in our surroundings (Bell 2012), and the imposition of such blatant order on their landscape must have sent out the message that these communities were very much in control. Indeed, with the capacity for creativity and the ability to mobilize the means of construction that the systems evidence, it is likely to have been more than just a message. The distinctiveness of the coaxial systems may have created (or heightened) a sense of social separation between communities (or, from the opposite perspective, inclusion within the community/communities building the fields) - especially if they were gradually assimilating plots of land as they expanded. In spite of any attempt at a sweeping new regime, the systems appear to have retained a nod to the old traditions, with a bias towards alignment on the solar arc (although it would be interesting to discover how the contemporaneity or otherwise of the systems was related to this).

Straight lines may also, of course, have demonstrated a practical response to dividing up the land in the simplest (in terms of concept) and most direct manner possible. A superficial lack of earlier field systems does not preclude the possibility that the land was already divided up by less long-lasting methods, but it is presumed that the builders intended to embrace the permanency and solidity of the stone they used rather than it being a coincidence that the local building material offered these qualities. This implies long-term settlement and a sense of 'knowing what they wanted to achieve', relating presumably to a sense of ownership. The simplicity of the concept of parallel field boundaries belies a more complex laying out procedure, required in order to maintain the accuracy of parallel lines over the uneven terrain. The technique remains unknown, although experimental approaches have attempted to recreate possibilities including visual estimation of distance and measurement with ropes (see Wickstead 2008: 144-145). There may have been sufficient demand for itinerant craftspeople maintaining the appropriate skills. Similarly, the presence, in places, of the remains of faced walls, as opposed to unstructured clearance piles, reflect the effort that must have gone into constructing these monuments. Both factors imply an element of planning of the systems, as does the repetition of basic components of the pattern between field systems. Nevertheless, the overlapping of Yorkshire systems in discrete places and the application of work on Dartmoor (Johnston 2005) and Perry Oaks (Lewis *et al*. 2010) suggest that the systems could have accreted over a period of time.

Certainly in the Dales, and to a large extent elsewhere, there is a tendency for focus to fall particularly strongly on the 'positive' evidence of the boundaries themselves, rather than the 'negative' 'gaps' between them, which is perhaps inevitable given that the latter are less immediately archaeologically visible, depending on active sub-surface investigation. It is very likely, however, that the individuals who built and used the field systems took the opposite approach: while the practicality of a stock proof boundary does not necessarily preclude any coexistent symbolic role it may have had, it would nevertheless have served as a practical means to an end to contain, delineate or control the resource, produce or space within. It may have been, for instance, that the fields facilitated a conspicuous display of wealth, in the form of livestock, belonging either to individuals or a small settlement. Their location on the higher valley sides makes them somewhat difficult to see from modern route ways, while the stepped profile of many of the field systems makes them difficult to view in their entirety from the hillside itself. The location of prehistoric route ways, however, is unknown: a better view may have been afforded from higher paths, or ones that ran through the fields themselves, deliberately steering the journey. Perhaps outsiders were only supposed to catch glimpses of this wealth, with the stepped fields unfolding as the traveller moved through the landscape.

7.3 Identity of the boundary builders

There is very little direct evidence as to the identity of the inhabitants of the Yorkshire Dales during the later prehistoric period. It is apparent from the size and scale of the boundaries that they were unlikely to have been built by individuals or even single families and there must, therefore, have been some degree of cooperation involved in their construction, drawing on organizational skills and vision to ensure the materialization of the structures in four dimensions. Such cooperation may have been generated by coercion or by consensus, or emerged from a point on the spectrum between the two - the builders may not have been the same people as the field users. Indeed, even if boundary building was a by-product of pasture improvement, the construction and maintenance of the faced walls would have come at the expense of the availability of labour for other essential tasks (although the use of slave labour may have been a possibility (Arnold 1988; Taylor 2001)). It is possible that the prominent employment of such quantities of labour required to monumentalize the landscape in this way was as much an end in itself as the construction of useful boundaries. Even if the network of boundaries as a whole was an accumulation of the work of generations, the construction of individual axials, including stone collection, would have been arduous. It may be appropriate to see the physically demanding work of boundary creation set against the backdrop of Sharples' description of hill fort construction as similar to a 'potlatch' ceremony, with conspicuous consumption of food and drink alongside the utilization of labour, albeit on a smaller social and economic scale (Sharples 2010: 116). Where the mobilization of labour had previously been focused on monuments such as burial mounds for individuals or individual families, it now revolved around a more community-focused project (however exclusive that community was in practice).

There is not yet much definitive evidence for the practice of either arable or pastoral farming in the Dales, although a mixed approach with relatively little cereal production is likely, based on pollen evidence (Fleming & Laurie 1993), elevation and the available terrain. The association of radiocarbon-dated sheep and cattle bones with early Neolithic burials in Dales cave systems suggests a much earlier precedent for the farming of these species in the area (T. Lord & T. Taylor, unpublished data in O'Connor 2011). Seasonal use of the land above the enclosed coaxial fields, as summer pasture, would allow the enclosed land to be 'cultivated' as hay meadow - modern management would determine that animals were then returned to the meadow to eat remaining vegetation after harvest, break up the soil and tread seeds into the ground surface (Gamble & St Pierre 2010: 24-6). The stock could overwinter in the relative shelter of the field systems, with the hay providing winter fodder. The enclosure of animals in the sub-divided coaxial strips, would allow greater control during, for example, lambing periods or when sorting stock for exchange or trade, and provide manure to enhance any small 'garden' cereal plots. This practice is an effective economic system observable in the Yorkshire Dales today and practiced for centuries. Although the land holdings of many farms, particularly in the eastern and southern dales, are not contiguous, they still maintain access to a variety of land-types for this reason. Clearing axial strips of stone to improve pasture and/or acquire building materials may also have been a seasonal activity, it presumably being easier to deal with the soft ground and reduced vegetation of the winter months, already quieter in terms of work load than the busy spring and harvest periods. Sheep are particularly well suited to drier limestone landscapes as they need little water, extracting what they need from the grasses, and are less inclined to welfare problems such as foot rot. Sheep may also have been more suited to the steep terrain than cattle, although late prehistoric cows were probably smaller and more capable than their modern descendants. The valley floor, although (and because) seasonally wet, would have provided a contrasting resource, offering fishing and fowling opportunities as well as sources of water, vegetation including reeds and wood, and clay, and possibly sods for fertilizing small arable plots (see Arnoldussen 2016b; Spek *et al*. 2003).

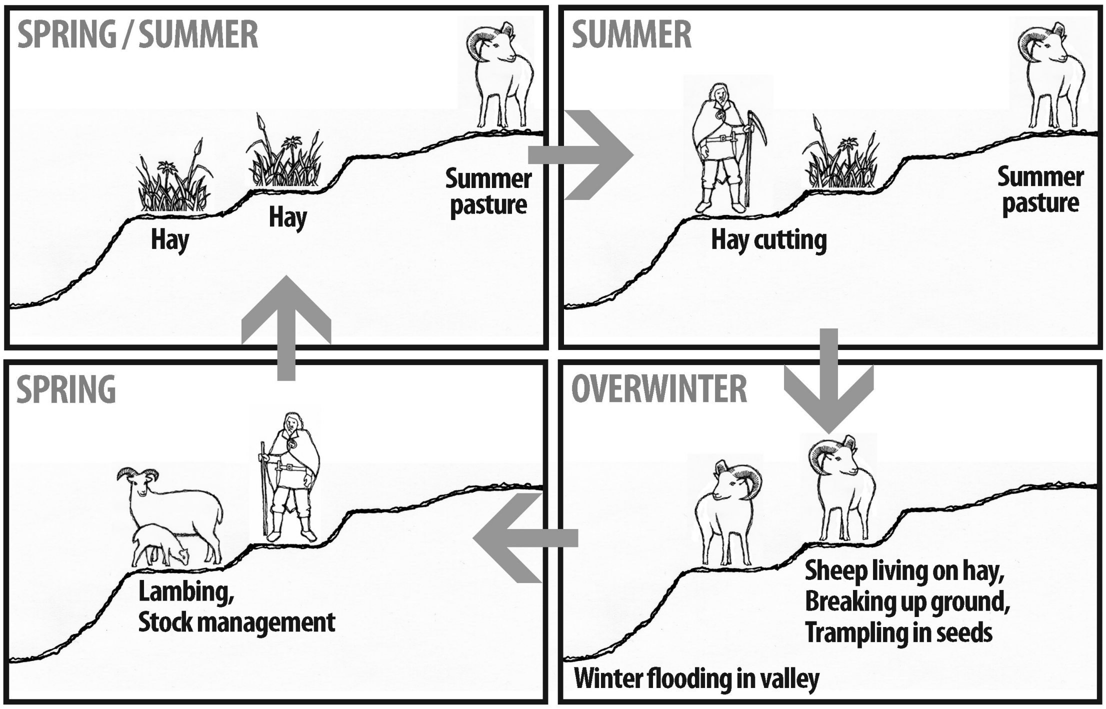


Fig. 7.1 Diagrammatic representation of suggested land use cycle taking place within the coaxial field systems, which are located on the upper, often terraced, dale sides, above the wet valley floor and below the summer moorland pasture.

It is unlikely that the twenty-four field systems studied here were entirely contemporaneous in build - the over-lapping of the Reeth and Healaugh systems hints at this - but it is unknown how and why each system was begun and what relationship each had to the others when in use. It is probable that the individuals that worked the fields in the Dales lived nearby, as is assumed from other, excavated, coaxial landscapes including Perry Oaks (2010: 175-186) and Shovel Down (Johnston *et al*. 2003); the remains of the settlement are likely to be among the scattered, undated, stone remains visible on the surface, although excavation on Dartmoor also revealed an assortment of wooden features (Fleming 2008: 115-116), which, if found in the Dales, would imply that the prehistoric landscape was wooded to a far greater extent than today. While the valley sides and interfluves may have posed something of a minor obstacle, creating, as today, a localized sense of community within a dale, the inhabitants of each valley would have been component parts of wider intra- and inter-dale networks, through which economic, social, political and cultural transactions could take place. The drier and flatter terraces of the valley sides (where not enclosed by field systems) may well have offered easier travelling than the modern preference for the valley floors. Livestock exchange would have been of particular importance, however, Pryor has suggested such proceedings would have had as much to do with social connections and alliances as economic settlements or pastoral concerns (Pryor 2006: 125-127). It is also likely that the Dales inhabitants would have had links with areas beyond the immediate surroundings of the Dales - most likely to the east via the Vale of York area, given the topography and relative ease of routes in this direction, although the value of other links is likely to have been worth more taxing journeys.

It is possible that the availability of lead (and associated semi-precious minerals) in the region offered a further opportunity for exploitation and trade: Roman exploitation and processing of lead is known from finds of two inscribed lead pigs (MYD36731) and the use of the ore before this is not an unreasonable possibility. The early post-conquest date of AD 81 on these lead pigs might suggest that production was taken over rather than established from scratch. It may not be a coincidence that the largest groups of field systems are located on the edges of the major ore fields in Swaledale/Arkengarthdale and Grassington Moor (fig. 7.2). Finds of possible seventh-century BC lead axe fragments from Mam Tor (Derbyshire) and a possible half of a lead torc of the late Bronze/early Iron Age purposefully deposited at Gardom's Edge (Derbyshire), alongside ore fields, have raised the possibility of prehistoric lead smelting in the Peak District (Barnatt 1999). Lead has frequently been detected in small quantities in copper alloys from the late Bronze Age onwards, although it has been suggested that this reflects contamination rather than deliberate combination, as copper ore is often found in association with galena (Barnatt 1999: 22). The production of surpluses as a result of more intensive farming may have underpinned such links, with trade possibilities including fleece, meat and other animal products being delivered either pre-processed (although there is as yet no evidence for their production in the Dales) or 'on the hoof'. Furthermore, the proposed presence of stock raises the possibility of livestock raiding, either on an *ad hoc* basis or possibly as an integral part of the economy and culture, with additional social connotations (Fukui 1996).

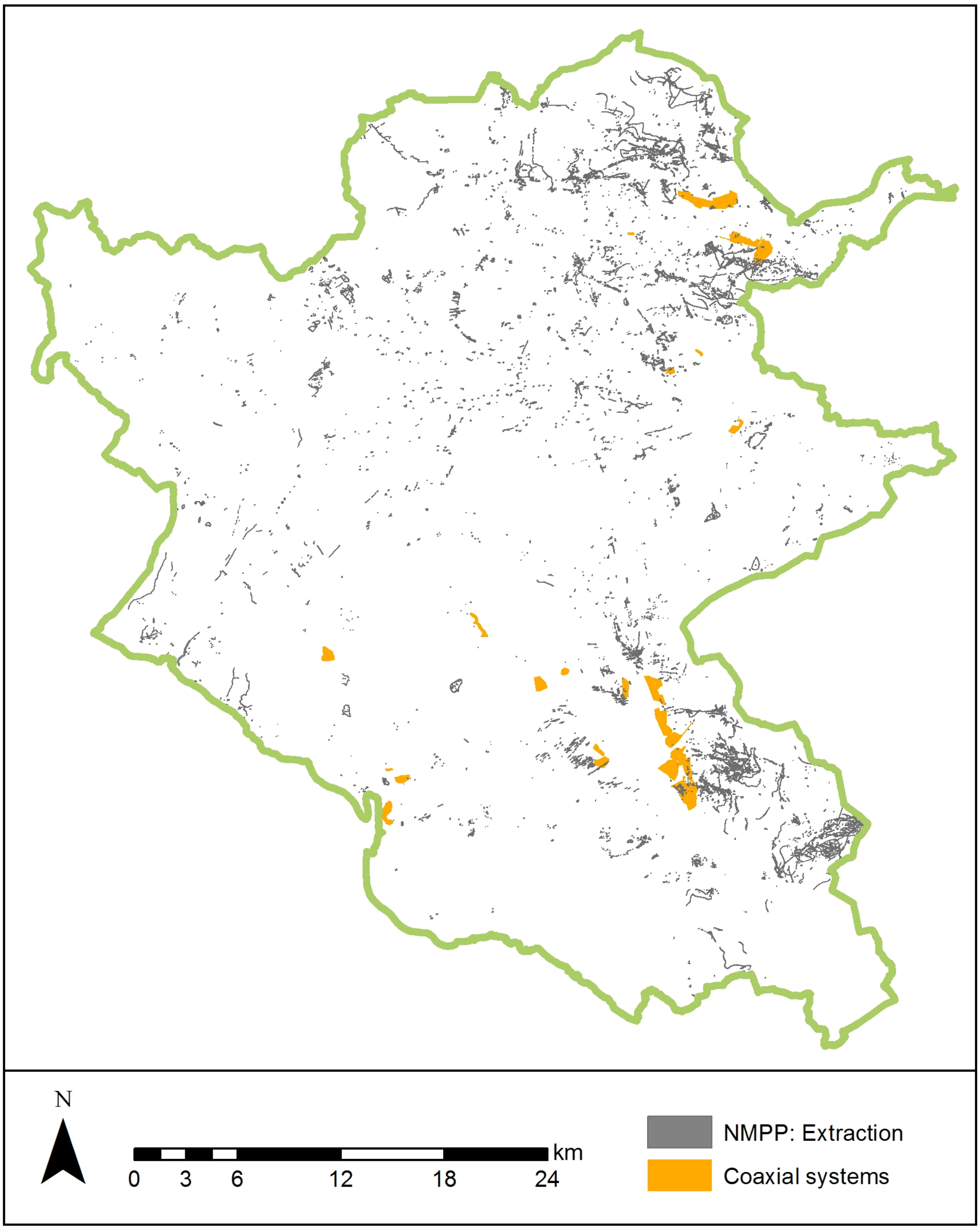


Fig. 7.2 Map of main lead ore fields in the Yorkshire Dales National Park (represented by National Mapping Pilot Project data for extractive industries i.e. predominantly lead, some small scale quarrying and coal extraction).

The relative coverage of the landscape by coaxial systems (i.e. 0.83% of the National Park, compared with 2.94% on Dartmoor) suggests a relatively sparse population, particularly when remembering that probably not all of the boundary systems were built contemporaneously. It is not clear whether the builders of the field systems were incoming settlers, bringing new ideas from elsewhere, or whether they were indigenous peoples, developing ideas as a matter of convergent evolution. It may be that there was a hierarchy of coaxial systems, differentiated by the quality of land, with the biggest - Grassington-Kettlewell system 6 and Harkerside - able to support more stock, demonstrate greater wealth and generate more lucrative trade opportunities. On the other hand, it is possible that larger areas were a reflection of poorer ground with the setup having to be expanded further to maintain the same livestock value.

7.4 Conclusion

Analysis of the information extracted from the source datasets of this study suggests that the coaxial field systems of the Yorkshire Dales, which are assumed to be late prehistoric in date, have enough in common with systems elsewhere to imply that inter-regional cultural links existed, probably extending over a prolonged period of time. Yet there are also aspects of the archaeological remains that are peculiar to the Dales systems. Far from working in a manner oblivious to the terrain, the builders of these systems seem to have embraced the natural topography and incorporated its challenges into their organization in a very deliberate fashion. Whether this was a purposeful adaptation of known existing ideas, the intentional adoption of ideas from elsewhere or a coincidental response to the individual landscape of the Dales is difficult to determine at this stage. Far from being “inherently inflexible” (Yates 2010: 289), the boundaries may reflect the simplest and most economical means of subdividing the useful and manageable flat terraces of the valley sides, however, their physical structure implies more of a presence was required than that demanded by merely the simplest pastoral system, suggesting either the control of large numbers of livestock or a monumental element to the boundaries, or both. At a smaller scale, the suffusion of physical landscape features with a supplementary mental landscape of meaning, would also have applied to features within the field systems and to the systems themselves.

The morphological variation identified in this study between systems on the Great Scar limestone areas of the southern Dales and the coaxial systems of

Swaledale may indicate differences in time or culture, or simply emphasize the plasticity of an overall model of boundary building when applied to subtly differing topography. Similarly, the lack of evidence for coaxial systems from the northwestern portion of the National Park might indicate a lack of amenable land in this region, a prevalence of consequent streams flowing directly down the hillside and requiring less visible effort to be put into land division, or a preference for well-drained, lime-rich land in the lee of the Pennine peaks. Although roughly half of the systems are located on land facing south or southwest, which could be argued to reflect the highest levels of insolation and therefore the best welfare and growing conditions for the livestock and pastures, the orientation of the boundaries demonstrates a noticeable bias towards the solstice sunrises and/or sunsets, suggesting a conceptual as well as pragmatic justification behind the alignment.

Until there is more evidence of the people and for their way of life, ethnography and studies of other examples suggest that not only would the landscape be important to the people of the Dales but that it would have been imbued with tradition and belief. Response to the landscape would also be part of a pastoral way of life, the most immediate economy for this upland limestone landscape. Whether or not mineral working was a part of the life of the people who built these systems, there is a strong link geographically between the distribution of the systems and the availability of lead. Organization of water supplies would have been integral to the functioning of the systems. The availability of land with similar orientation, sunny disposition, lee of rainfall and elevation compared with the land used by the systems suggests that the population was not large in relation to what the land would support.

8. Conclusion

The hillsides of the Yorkshire Dales have witnessed millennia of dissection and division, and many still bear the archaeological scars to prove it. Some of the oldest remaining of these scars, the stony linear boundaries that together are aligned into coaxial systems, have been paid remarkably little attention despite the fact that the systems cover tens and hundreds of hectares of comparatively well-known and well-used land. This project therefore set out to disentangle and draw together the existing evidence relating to the coaxials, determine their current extent and common characteristics and explore some of the circumstances of their creation, thus enriching our limited understanding of the later prehistoric landscape of the Dales. In so doing, this work has contributed directly to the Yorkshire Dales Historic Environment Record through the clarification and enhancement of database records and the contribution of GIS materials; this will in turn inform and enlighten the management of the archaeological resources of the National Park, potentially playing a part in introducing the later prehistoric archaeology of the Park to a wider audience.

The foundations of this research lie in the existing datasets - cartographic, photographic, documentary and archaeological - that directly or indirectly evidence the coaxial field systems of the National Park. These were acquired from a variety of sources and appraised, 'cleaned' and digitized (see Chapter 3). The digital environment of a geographical information system provided the means by which to visualize, manipulate, and interrogate the data in order to extract relevant quantitative and qualitative details (Chapters 4-5). Analysis of these details facilitated the consideration of the nature and characteristics of the boundaries against the backdrop of a wider geographical area (Chapter 6) and the social and political circumstances that precipitated them at a local level (Chapter 7). Contributing a deliberately broad overview of the systems of the Dales, this research marks a new campaign of research in the field and offers a frame of reference in which to place future work. In terms of the collaborative element of the Collaborative Doctoral Award, this research offers a GIS-based dataset that has been incorporated into the HER, alongside new information that has been used to enhance the existing monument records. This information has become public data, accessible on a day-to-day basis through the YDNPA, and will be of practical use, for example in the planning process and in land management initiatives such as Countryside Stewardship Schemes (DEFRA 2014).

The assumption - and until further work is conducted, it will remain an assumption - that the coaxial systems of the Dales date from the later prehistoric period is based primarily on morphological similarities with a number of other systems, largely in southern England. At a time of increasing permanent settlement and increasingly visible land tenure, shared attributes of form with systems elsewhere - not only parallel structures but also orientation - suggest elements of shared culture while local idiosyncrasies reflect flexibility of thinking. The distribution of the extant systems suggests a preference for the limestone terraces, with their better drainage, relatively open vistas and suitability for pastoral economies. While there seems to be a preference for limestone, within the National Park there are differences in the limestone that seem to parallel the differences between the systems of the southern Dales (on the Great Scar karst landscape) and those of Swaledale (on the Yoredale Series limestones). Although the Swaledale systems reflect many of the characteristics of coaxial systems elsewhere, with transverse and terminal boundaries, those of the southern Dales are distinct, with their incorporation of landscape features as natural divisions in the system, far from ‘terrain oblivious’. Despite these local differences and the similarities with systems elsewhere, a feature that is common to both those of Swaledale and the southern Dales is the small size of the systems compared with the classic example of the Dartmoor reaves, which might suggest a smaller, sparser population and/or smaller social groups.

The collection of geophysical and walkover data pertaining to a small area of Grassington-Kettlewell system 6 as part of a second, complementary, PhD project, gives a glimpse of the potential work that will be required to fully understand these systems: admittedly this system is more overtly reworked than most, but the possibilities of complex multi-period landscapes with further subsurface variation must be expected (Mary Saunders, pers. comm.). Fieldwork was beyond the remit of this project, but during the course of the research several means have been identified through which further investigation could refine the findings. At the broadest scale, further prospection, either through the use of additional aerial sources and/or field investigation, would surely pay dividends (particularly given the expansion of the National Park in 2016) with regard to investigating possible systems and discovering new coaxial complexes, and determining the accuracy with which 'blank' areas of the map are labeled such. Although many nonintrusive techniques for further investigation, such as geophysical methods, carry issues of practicality in the upland landscape, their use for specific site appraisal would be valuable - especially through, for instance, the determination of the presence of extensions to visible systems or internal infilling and transverse boundaries that are not visible on the surface. At a narrower scale, targeted excavation would also be of vital importance. This would provide a means to investigate the nature of the surviving boundaries along with any antecedent forms, as well as any associated features, such as settlement evidence, given the precedent set by Dartmoor, where excavation revealed fences and round houses originally constructed of wood (Fleming 2008: 101-105). It would, of course, be essential to approach the coaxials not only as individual boundaries, but as dynamic systems and landscapes of multiple systems that developed in four dimensions, incorporating other 'monument types' such as settlements and droveways and evolving in response to contemporary social and political pressures.

Perhaps the most pressing issue, in terms of placing the coaxial systems of the Yorkshire Dales in their wider context, is establishing a date for their construction, use and/or abandonment in order to view them as accurately as possible within their local and general backgrounds. Inevitably, this is easier said than done: field systems have always been notoriously difficult to date, and these are no exception. In particular, the difficulties associated with extrapolating dating evidence from one system to another, and indeed, given their probable accretionary formation, from one wall, or part thereof, to another, can reduce the value of individual dates somewhat. The successful obtaining of dating evidence from a number of sites outside the Dales, including Shovel Down, Perry Oaks and Céide Fields as well as continental 'Celtic' field sites, is encouraging, and potential lies with methods such as OSL. In terms of relative dating evidence, close investigation of systems such as Grassington-Kettlewell 6 may illuminate the ways in which systems were modified by later users, as well as the relationship of the prehistoric boundaries with their later, medieval, counterparts.

These boundaries, which occur over large areas and are crossed by some of the most well-used paths in the region (in the case of the Grassington-Kettlewell systems and the Dales Way), have great potential for public understanding of archaeology and offer a valuable opportunity for public education. The chance could be taken to develop resources that make such features more accessible to the non-archaeologist (for example, several self-guiding walk leaflets were produced during the CDA placement). Not only important as a well-preserved late prehistoric landscape in their own right, they are also an integral component of the multi-facetted and unique Dales landscape.

Bibliography

Abe, Y., Marean, C.W., Nilssen, P.J., Assefa, Z. & Stone, E.C. (2002) The analysis of cutmarks on archaeofauna: a review and critique of quantification procedures, and a new image-analysis GIS approach. *American Antiquity* 67(4), 643-663.

Ainsworth, S., Gates, T. & Oswald, A. (2015) Swaledale's 'Early Medieval Kingdom' revisited. *Landscapes* 16(1), 3-17.

Amesbury, M.J., Charman, D.J., Fyfe, R.M., Langdon, P.G. & West, S. (2008) Bronze Age upland settlement decline in southwest England: testing the climate change hypothesis. *Journal of Archaeological Science* 35(1), 87-98.

Arnold, B. (1988) Slavery in late prehistoric Europe: recovering the evidence for social structure in Iron Age society. In Geselowitz, M.L. & Blair Gibson, D. (eds.) *Tribe and polity in late prehistoric Europe: demography, production and exchange in the evolution of complex social systems.* New York: Plenum Publishing Corporation. 179-192.

Arnoldussen, S. & Scheele, E.E. (2014) *De Celtic fields van Wekerom: kleinschalige opgravingen val wallen en velden van een laat-prehistorisch raatakkersysteem*. *Archaeologisch, bodemkundig, geochemisch en archaeobotanisch onderzoek van enkele wallen en venden van het Celtic field-complex van Wekerom*. Grondsporen 18. Rijksuniversiteit Groningen.

Arnoldussen, S. (2016) *Wetland signals in upland fields? Do wetlands have anything to do with Celtic fields?* Presentation given at the Wetland Archaeology Research Project 30 Conference, University of Bradford, 29th June 2016.

Aston, M. (1985) *Interpreting the landscape. Landscape archaeology in local studies*. London: Batsford.

Balaam, N.D., Smith, K. & Wainwright, G.J. (1982) The Shaugh Moor Project: fourth report - environment, context and conclusion. *Proceedings of the Prehistoric Society* 48, 203-278.

Barger, E. (1938) The present position of studies in English field-systems. *English Historical Review* 53, 385-411.

Baring Gould, S. (1900) *A book of Dartmoor*. London: Methuen.

Barnatt, J. (1999) Prehistoric and Roman mining in the Peak District: present knowledge and future research. *Mining History (Peak District Mines Historical Society bulletin)* 14(2), 19-30.

Barrett, J. & Bradley, R. (eds.) (1980) *Settlement and society in the British later Bronze Age*. BAR British Series 83. Oxford: Archaeopress.

Barrett, J.C. & Ko, I. (2009) A phenomenology of landscape: a crisis in British landscape archaeology? *Journal of Social Archaeology* 9: 275-294.

Behre, K.E. (2000) Frühe Ackersysteme, Düngemethoden und die Entstehung der nordwestdeutschen Heiden. *Archäologisches Korrespondenzblatt* 30, 135-151.

Bell, S. (2012) *Landscape: pattern, perception and process*. 2nd edition. London: Routledge.

Bender, B., Hamilton, S. & Tilley, C. (2007) *Stone worlds: narrative and reflexivity in landscape archaeology*. Walnut Creek: Left Coast Press.

Benito-Calvo, A., Carvalho, S., Arroyo, A., Matsuzawa, T. & de la Torre, Ignacio (2015) First GIS analysis of modern stone tools used by wild chimpanzees (*Pan troglogytes verus)* in Bossou, Guinea, West Africa. *PLoS ONE* 10(3), e0121613.

Blaker, R. (1902) Ancient cultivations. *Sussex Archaeological Collections* 45, 199-203.

Bowden, M. (2001) Mapping the past: OGS Crawford and the development of landscape studies. *Landscapes* 2, 2-45.

Bowen, H.C. & Fowler, P. (1978) *Early land allotment in the British Isles*. BAR British Series 48. Oxford: Archaeopress.

Bowen, H.C. (1961) Ancient fields. *A tentative analysis of vanishing earthworks and landscapes.* London: The British Association for the Advancement of Science.

Bradley, R. (1978) Prehistoric field systems in Britain and north-west Europe - a review of some recent work. *World Archaeology* 9(3), 265-280.

Bradley, R. & Richards, J. (1978) Prehistoric fields and boundaries on the Berkshire Downs. In Bowen, H.C. & Fowler, P. (eds.) *Early land allotment in the British Isles.* BAR British Series 48. Oxford: Archaeopress. 53-60.

Bradley, R., Entwistle, R. & Raymond, F. (1994) *Prehistoric land divisions on Salisbury Plain. The work of the Wessex Linear Ditches Project*. Archaeological Report Number 2. London: English Heritage.

Bradley, R. & Yates, D. (2007) After ‘Celtic’ fields: the social organisation of Iron Age agriculture. In Haselgrove, C. & Pope, R. (eds.) *The earlier Iron Age in Britain and the near Continent*. 94-102.

Breen, E. (2008) Encounters with place in prehistory: writing a case study for Shipman Head Down, Isles of Scilly. In Chadwick, A.M. (ed.) *Recent approaches to the archaeology of land allotment*. BAR International Series 1875. Oxford: Archaeopress. 97-109.

Brongers, J.A. (1976) *Air photography and Celtic field research in the Netherlands*. Amersfoort: Rijksdienst voor het Oudheidkundig Bodemonderzoek.

Brück, J. (1995) Experiencing the past? The development of a phenomenological archaeology in British prehistory. *Archaeological dialogues* 12(1), 45-72.

Brück, J., Fyfe, R., Johnston, R., Lewis, H. & Wickstead, H. (2004) *Shovel Down Project summary report*. Unpublished report.

Brück, J., Fyfe, R., Johnston, R., Lewis, H. & Wickstead, H. (2005) *A divided land. Field systems, land use and society on Bronze Age Dartmoor*. Unpublished project design.

Burleigh, R., Matthews, K., Ambers, J. & Kinnes, I. (1981) British Museum natural radiocarbon measurements XII. *Radiocarbon* 23, 14-23.

Butler, J. (1991a) *Dartmoor atlas of antiquities. Volume 1: the east.* Exeter: Devon Books.

Butler, J. (1991b) *Dartmoor atlas of antiquities. Volume 2: the north.* Exeter: Devon Books.

Butler, J. (1993) *Dartmoor atlas of antiquities. Volume 4: the south-east.* Exeter: Devon Books.

Butler, J. (1991a) *Dartmoor atlas of antiquities. Volume 3: the south-west.* Tiverton: Devon Books.

Butler, J. (1997) *Dartmoor atlas of antiquities. Volume 5: the second millennium BC.* Tiverton: Devon Books.

Cardwell, P., Elliott, F. & Hanson, J. (1990) Grimwith to Nidd aqueduct link. Archaeological survey and excavation. Unpublished report. Archaeological Services for Yorkshire Water Plc.

Caseldine, C.J. (1999) Archaeological and environmental change on prehistoric Dartmoor: current understandings and future directions. *Journal of Quaternary Science* 14, 575-583.

Caulfield, S. (1978) Neolithic fields: the evidence. In Bowen, H.C. & Fowler P. (eds.) *Early land allotment in the British Isles*. BAR British Series 48. Oxford: Archaeopress. 137-144

Caulfield, S. (1983) The Neolithic settlement of north Connaught. In Reeves-Smyth, T. & Hammond, F. (eds.) *Landscape archaeology in Ireland*. BAR British Series 116. Oxford: Archaeopress. 195-215.

Caulfield, S., O'Donnell, R.G. & Mitchell, P.I. (1998) C14 dating of a Neolithic field system at Céide Fields, County Mayo, Ireland. *Radiocarbon* 40, 629-640.

Chadwick, A.M. (2004) Geographies of sentience - an introduction to space, place and time. In Chadwick, A. (ed.) *Stories from the landscape: archaeologies of inhabitation*. BAR International Series 1238. Oxford: Archaeopress. 1-31.

Chadwick, A.M. (2008a) Introduction. In Chadwick, A.M. (ed.) *Recent approaches to the archaeology of land allotment*. BAR International Series 1875. Oxford: Archaeopress. 1-23.

Chadwick, A.M. (2008b) Fields for discourse? Towards more self-critical, theoretical and interpretative approaches to the archaeology of field systems and land allotment. In Chadwick, A.M. (ed.) *Recent approaches to the archaeology of land allotment*. BAR International Series 1875. Oxford: Archaeopress. 205-238.

Chadwick, A.M. (ed.) (2008c) *Recent approaches to the archaeology of land allotment*. BAR International Series 1875. Oxford: Archaeopress.

Chadwick, A.M. (2013) Some fishy things about scales: macro- and micro-approaches to later prehistoric and Romano-British field systems. *Landscapes* 14(1), 13-32.

Cherry, P.J. (1998) Prehistoric habitation sites at Grassington, North Yorkshire. *Yorkshire Archaeological Journal* 70, 1-23.

Chiverell, R.C., Oldfield, F., Appleby, P.G., Barlow, D., Fisher, E., Thompson, R. & Wolff, G. (2008) Evidence for changes in Holocene sediment flux in Semer Water and Raydale, North Yorkshire, UK. *Geomorphology* 100(1-2), 70-82.

Cook, J., Huckerby, E., Quartermaine, J., & Wearing, N. (2008) The Ribble Valley: a methodological study in landscape development. *Landscapes* 1, 28-49.

Crawford, O.G.S & Keiller, A. (1928) *Wessex from the air*. Oxford: Clarendon Press.

Crawford, O.G.S. (1923) Air survey and archaeology. *The Geographical Journal* 61(5), 342-360.

Crowther, J. (1930) *Silva Gars (Grass Wood) Grassington: its history, antiquities, ancient footpaths, wild flowers and wild life, together with a guide to twenty-seven interesting walks in the district with map and illustrations.* Grassington: Wadsworth & Co.

Curwen, E. & Curwen, E.C. (1923) Sussex lynchets and their associated fieldways. *Sussex Archaeological Collections* 64, 1-65.

Curwen, E. (1928) Ancient cultivations at Grassington, Yorkshire*. Antiquity* 2, 168-172.

Curwen, E.C. (1927) Prehistoric agriculture in Britain*. Antiquity* 1, 261-289.

Curwen, E.C. (1932) Ancient Cultivations. *Antiquity* 6, 389-406.

DCLG (1990) *Planning policy guidance 16: archaeology and planning.* Last accessed 29th August 2016. Available online at http://webarchive.nationalarchives.gov.uk/20120918132719/http://www.communities.gov.uk/documents/panningandbuilding/pdf/156777.pdf

Dearne, M.J. & Lord, T.C. (1998) *The Romano-British Archaeology of Victoria Cave, Settle.* BAR British Series 273. Oxford: Archaeopress.

DEFRA (2014) The new common agricultural policy schemes in England: December 2014 update. Last accessed 14th June 2016. Available online et https://www.gov.uk/government/publications/cap-reform-december-2014-update

Denny, H. (1859) On the geological and archaeological contents of the Victoria and Dowkabottom Caves in Craven. *Proceedings of the Geological and Polytechnic Society of the West Riding of Yorkshire* 4, 45-74.

Donahue, R.E. & Lovis, W. (2000) *Yorkshire Dales Hunter-Gatherer Research Project interim report 1999.* Unpublished report, University of Bradford.

Earle, T. (2002) *Bronze Age economics: the first political economies*. Boulder, CO: Westview Press.

EngLaId (2014) Project introduction page. Last accessed 21st July 2016. http://www.arch.ox.ac.uk/englishlandscapes-introduction.html

English, J. (2013) *Pattern and progress: field systems of the Second and early First Millennia BC in Southern Britain*. BAR British Series 587. Oxford: Archaeopress.

Fairless, K. (2004) Burton Moor settlement. In White, R.F. & Wilson, P.R. (eds.) *Archaeology and Historic landscapes of the Yorkshire Dales.* Yorkshire Archaeological Society Occasional Paper Number 2. Leeds: Yorkshire Archaeological Society. 99-104.

Farmer, D. (ed.) (1990) *Bede. Ecclesiastical history of the English people.* Revised edition. London: Penguin.

Fleming, A. (1978) The prehistoric landscape of Dartmoor. Part 1: South Dartmoor*. Proceedings of the Prehistoric Society* 44, 97-123.

Fleming, A. (1983) The prehistoric landscape of Dartmoor. Part 2: North and East Dartmoor*. Proceedings of the Prehistoric Society* 49, 195-241.

Fleming, A. (1987) Coaxial field systems: some questions of time and space. *Antiquity* 61, 188-202.

Fleming, A. (1994) The reaves revisited. *Proceedings of the Devon Archaeological Society* 52, 63-74.

Fleming, A. (2008) *The Dartmoor reaves. Investigating prehistoric land divisions*. 2nd edition. Oxford: Windgather Press.

Fleming, A. (2010) *Swaledale. Valley of the wild river.* Oxford: Windgather Press.

Fleming, A. & Collis, J. (1973) A late prehistoric reave system near Cholwich Town, Dartmoor. *Devon Archaeological Society Proceedings* 31, 1-21.

Fleming, A. & Laurie, T. (1984-1993) *Swaledale Ancient Land Boundaries Project interim reports 1-10.* Last accessed 14th August 2016. Accessible from: https://www.swaag.org/publications_TimLaurie_InterimReports.htm

Fowler, P. (1978) Pre-medieval fields in the Bristol region. In Bowen, H.C. & Fowler, P. (eds.) *Early land allotment in the British Isles.* BAR British Series 48. Oxford: Archaeopress. 29-47.

Fowler, P. (2000) *Landscape plotted and pieced: landscape history and local archaeology in Fyfield and Overton, Wiltshire.* London: The Society of Antiquaries of London for English Heritage.

Fukui, K. (1996) Conflict as a levelling mechanism. Analysis of cattle composition and raiding among the Narim in southern Sudan. *Nilo-Ethiopian Studies* 3-4, 1-23.

Fyfe, R.M., Brück, J., Johnston, R., Lewis, H., Roland, T.P. & Wickstead, H. (2008) Historical context and chronology of Bronze Age land enclosure on Dartmoor, UK. *Journal of Archaeological Science* 35, 2250-2261.

Gaffney, V., Fitch, S., Ramsey, E., Yorston, R., Ch'ng, E., Baldwin, E., Bates, R., Gaffney, C., Ruggles, C., Sparrow, T., McMillan, A., Cowley, D., Fraser, S., Murray, C., Murray, H., Hopla, E. &. Howard, A. (2013) Time and a place: a luni-solar 'time-reckoner' from 8th millennium BC Scotland. *Internet Archaeology* 34. Last accessed 7th July 2016. http://dx.doi.org/10.11141/ia.34.1

Gamble, D. & St Pierre, T. (2010) *Hay time in the Yorkshire Dales. The natural, cultural and land management history of hay meadows.* Lancaster: Scotfort Books.

Gawne, E. & Somers Cocks, J.V. (1968) Parallel reaves on Dartmoor. *Transactions of the Devonshire Association for the Advancement of Science* 100, 277-291.

Giles, M. (2006) Collecting the past, constructing identity: the antiquarian John Mortimer and the Driffield Museum of Antiquities and Geological Specimens. *The Antiquaries Journal* 86, 279-316.

Giles, M. (2012) *A forged glamour: landscape, identity and material culture in the Iron Age*. Oxford: Windgather Press.

Gillings, M. & Goodrick, G.T. (1996). Sensuous and reflexive GIS: exploring visualisation and VRML. *Internet Archaeology*, 1. Last accessed 29th August 2016. http://dx.doi:10.11141/ia.1.2

Gingell, C. (1992) *The Marlborough Downs: a later Bronze Age landscape and its origins*. Devizes: Wiltshire Archaeological and Natural History Society/Trust for Wessex Archaeology.

Gosden, C. (2013) Fields. In Bergerbrant, S. & Sabatini, S. (eds.) *Counterpoint: essays in archaeology and heritage studies in honour of Professor Kristian Kristiansen*. BAR International Series 2508. Oxford: Archaeopress. 111-117.

Gosden, C. & Lock, G. (1998) Prehistoric histories. *World Archaeology* 30(1), 2-12.

Green, C. (2016a) *Englaid blog: Field systems (IV).* Last accessed 29th August 2016. https://englaid.com/2016/04/08/field-systems-iv/

Green, C. (2016b) *The way that I field: analysing field system morphology using GIS*. Computer Applications and Quantitative Methods in Archaeology UK Chapter Conference, Leicester, March 2016. Accessed at: https://www.youtube.com/watch?v=1b432DpgQRE

Harker, B.J. (1892) Discovery of prehistoric remains at Grassington, in Craven, Yorkshire. *The Antiquary* 26, 147-149.

Hatt, G. (1931) Prehistoric fields in Jylland. *Acta Archaeologia* 2, 117-58.

Hetherington, D., Lord, T.C. & Jacobi, R.M. (2005) New evidence for the occurrence of Eurasian lynx (*lynx lynx*) in medieval Britain*. Journal of Quaternary Science* 21(1), 3-8.

Higginbottom, G., Smith, A.G.K. & Tonner. P. (2015) A recreation of visual engagement and the revelation of world views in Bronze Age Scotland. *Journal of Archaeological Method and Theory* 22, 584-645.

Higham, N.J. (1978) Early field survival in north Cumbria. In Bowen, H.C. & Fowler, P.J. (eds.) *Early land allotment in the British Isles*. BAR British Series 48. Oxford: Archaeopress. 119-125.

Hinton, D. (1997) The 'Scole-Dickleborough field system' examined. *Landscape history* 39, 5-13.

Holleyman, G.A. (1935) The Celtic field system in south Britain: a survey of the Brighton district. *Antiquity* 9(36), 443-454.

Horne, P. & MacLeod, D. (1995) (Pdf version 2011) *The Yorkshire Dales Mapping Project. A report for the National Mapping Programme*. Air Photography Unit, Royal Commission on the Historical Monuments of England.

Horne, P. & MacLeod, D. (2001) Unravelling a Wharfedale landscape: a case study in field enhanced aerial survey. *Landscapes* 2, 65-82.

Horne, P. & MacLeod, D. (2004) The RCHME's Yorkshire Dales Mapping Project. In White, R.F. & Wilson, P.R. (eds.) *Archaeology and historic landscapes of the Yorkshire Dales*. Yorkshire Archaeological Society Occasional Paper Number 2. Leeds: Yorkshire Archaeological Society. 15-24.

Hoskins, W.G. (1981) *The making of the English landscape*. 2nd edition. London: Book Club Associates.

Ingold, T. (1993) Conceptions of time and ancient society*. World Archaeology* 25(2), 152-174.

Johnson, N. & Rose, P. (1994) *Bodmin Moor: an archaeological survey. Volume 1: the human landscape to c1800*. London: English Heritage.

Jecock, M. (1998) High Park, Lancashire and Cow Close, Cumbria. An archaeological survey. RCHME survey report.

Johnston, R. (2001) 'Breaking new ground': land tenure and fieldstone clearance during the Bronze Age*.* In Brück, J. (ed.) *Bronze Age landscapes. Tradition and transformation*. Oxford: Oxbow. 99-109.

Johnston, R. (2005) Pattern without a plan: rethinking the Bronze Age coaxial field systems on Dartmoor, south-west England. *Oxford Journal of Archaeology* 24(1), 1-21.

Johnston, R., Wickstead, H. & Brück, J. (2003) *Shovel Down Project summary report*. Unpublished report.

Johnston, R. & Wickstead, H. (2005) Geophysical surveys on Shovel Down and Kes Tor, Dartmoor, Devon, 2003 and 2004. Unpublished survey report.

Jones, E. (1888) On the recent exploration of a cave at Elbolton, near Thorpe. *Proceedings of the Yorkshire Geological and Polytechnic Society* 11, 86-90.

Jones, C. (2008) Roughan Hill prehistoric landscape. In *Burren landscape and settlement. An INSTAR Project*. Project report. The Heritage Council (Ireland). 42-53.

Jones, C. (2016) Dating ancient field walls in karst landscapes using differential bedrock lowering. *Geoarchaeology* 31(2), 77-100.

Kooistra, M.J. & Maas, G.J. (2008) The widespread occurrence of Celtic field systems in the central part of the Netherlands. *Journal of Archaeological Science* 35, 2318-2328.

Kvamme, K.L. (1999) Recent directions and developments in geographical information systems. *Journal of Archaeological Research* 7(2), 153-201.

Kvamme, K.L. (2012) Spatial information technologies and landscape archaeology: past problems and future directions. In Bebermeier, W., Hebenstreit, R., Kaiser, E. & Krause, J. (eds.) *Landscape archaeology: proceedings of the international conference held in Berlin, 6th-8th June 2012. Journal of Ancient Studies* special vol. 3, 335-340.

Lancaster, W.T. (1915) *Abstracts of the charters and other documents contained in the chartulary of the Cistercian Abbey of Fountains in the West Riding of the county of York*. Leeds: Whitehead & Son.

Lang, V. (1994) Celtic and Baltic fields in north Estonia. Fossil field systems of the Late Bronze Age and Pre-Roman Iron Age at Saha-Loo and Proosa. *Acta Archaeologica* 65, 203-219.

Laurie, T. (1985) Early land division and settlement in Swaledale and on the eastern approaches to the Stainmore Pass over the North Pennines. In Spratt, D. & Burgess, C. (eds.) *Upland settlement in Britain. The second millennium BC and after.* BAR British Series 143. Oxford: Archaeopress. 135-162.

Laurie, T., Mahaffy, N.W. & White, R.F. (2011) Co-axial field systems in Swaledale: a reassessment following recent fieldwork. In Martlew, R.D. (ed.) *Prehistory in the Yorkshire Dales. Recent research and future prospects*. York: PLACE/YDLRT. 37-59.

Lewis, J., Brown, L. & Smith, A. (2006) *Landscape evolution in the Middle Thames Valley. Heathrow Terminal 5 excavations vol. 1 Perry Oaks*. Framework Archaeology Monograph No. 2. Oxford & Salisbury: Framework Archaeology.

Lewis, J., Leivers, M., Brown, L., Smith, A., Cramp, K., Mepham & Phillpotts, C. (2010) *Landscape evolution in the Middle Thames Valley. Heathrow Terminal 5 excavations vol. 2.* Framework Archaeology Monograph No. 3. Oxford & Salisbury: Framework Archaeology.

Lock, G. & Stančič, Z. (eds.) (1995) *Archaeology and Geographic Information Systems: a European perspective*. London: Taylor & Francis.

Long, D., Chambers, F.M. & Barnatt, J. (1998) The palaeoenvironment and the vegetation history of a later prehistoric field system at Stoke Flat on the gritstone uplands of the Peak District. *Journal of Archaeological Sciences* 25, 505-519.

Lord, T. & Howard, J. (2013) Cave archaeology. In Waltham, T. & Lowe, D. (eds.) *Caves and karst of the Yorkshire Dales*. Buxton: British Cave Research Association. 239-251.

Lord, T.C., O'Connor, T.P., Siebrandt, D.C. & Jacobi, R. (2007) People and large carnivores as biostratinomic agents in late glacial cave assemblages. *Journal of Quaternary Science* 22(7), 681-694.

Løvschal, M. & Holst, M.K. (2015) Repeating boundaries - repertoires of landscape regulations in southern Scandinavia in the Late Bronze Age and Pre-Roman Iron Age. *Danish Journal of Archaeology* 3(2), 95-118.

Løvschal, M. (2014) Emerging boundaries: social embedment of the landscape and settlement divisions in northwestern Europe during the first millennium BC. *Current Anthropology* 55(6), 725-750.

Løvschal, M. (2015) Line of landscape organization: Skovbjerg moraine (Denmark) in the first millennium BC. *Oxford Journal of Archaeology* 34(3), 259-278.

Martlew, R. (2004) Late prehistoric landscapes of Upper Wharfedale: problems and potential. In White, R.F. & Wilson, P.R. (eds.) *Archaeology and historic landscapes of the Yorkshire Dales*. Yorkshire Archaeological Society Occasional Paper Number 2. Leeds: Yorkshire Archaeological Society. 39-50.

Martlew, R.D. (2011) Late prehistory and the Roman Iron Age in Upper Wharfedale: problems, potential and progress. In Martlew, R.D. (ed.) *Prehistory in the Yorkshire Dales. Recent research and future prospects*. York: PLACE/YDLRT. 60-72.

Martlew, R. (2013) Chapel House Wood Landscape Project, interim report 2013. Available online at http://ydlrt.co.uk/chw_2013_interim.pdf

Maude, K. (1999) The very edge. Reappraising the Romano-British settlement in the Central Penines; the Littondale experience. In Nevell, M. (ed.) *Living on the edge of empire. Models, methodology and marginality*. Archaeology North West vol. 3. Manchester: CBA North West, Field Archaeology Centre, University of Manchester and Chester Archaeology. 42-46.

McOmish, D.S. (2005) Bronze Age land allotment on the Marlborough Downs. In McOmish, D.S., Field, D. & Brown, G. (eds.) *The Avebury landscape: aspects of the field archaeology of the Marlborough Downs*. Oxford: Oxbow. 133-136.

McOmish, D., Field, D. & Brown, G. (2002) *The field archaeology of the Salisbury Plain Training Area*. Swindon: English Heritage

Molloy, K. & O'Connoll, M. (1995) Palaeoecological investigations towards the reconstruction of environment and land-use changes during prehistory at Céide Fields, western Ireland. *Probleme der Küstenforschung im südlichen Nordseegebiet*. 23, 187-225.

Muir, R. (2000) *The new reading the landscape. Fieldwork in landscape history*. Exeter: University of Exeter Press.

Müller-Wille, M. (1979) Flursysteme der Bronze- und Eisenzeit in den Nordseegebieten. Zum Stand der Forschung über "celtic fields". *Untersuchungen zur eisenzeitlichen und frühmittelalterlichen Flur in Mitteleuropa un ihre Nutzung* 1, 197-239.

Natural England (2012) *Yorkshire Dales National Park (Designation) (Variation) Order.* Available online at http://webarchive.nationalarchives.gov.uk/20140605090108/http://www.naturalengland.org.uk/ourwork/conservation/designations/new/northwestdesignationproject/documents.aspx

Neubauer, W. (2004) GIS in archaeology - the interface between prospection and excavation. *Archaeological Prospection* 11, 159-166.

Nevell, M. (1999) Iron Age and Romano-British settlement in north west England. Theory, marginality and settlement. In Nevell, M. (ed.) *Living on the edge of empire: models, methodology and marginality*. Archaeology North West 3. 14-26.

Nowakowski, J. (2009) Living in the sands - Bronze Age Gwithian, Cornwall, revisited. In Allen, M., Sharples, N. & O'Connor, T. (eds.) *Land and people: papers in memory of John G. Evans.* Prehistoric Society research paper 2. Oxford: Oxbow. 115-125.

O'Connor, T. (2011) The changing environment of the Yorkshire Dales during the Late and Post-Glacial periods. In Martlew, R.D. (ed.) *Prehistory in the Yorkshire Dales. Recent research and future prospects*. York: PLACE/YDLRT. 1-12.

Oakey, M., Jecock, M., Hazell, Z., Linford, N., Linford, P. & Payne, A. (2015) National Archaeological Identification Survey: Upland Pilot. Project Report. Cumbria and Lancashire. English Heritage Research Report Series 10-2015.

Ordnance Survey (2013) OS Terrain 5 user guide and technical specification. http://digimap.edina.ac.uk/webhelp/os/data_files/os_manuals/os-terrain-5-user-guide_v1.1.pdf Last accessed 26th August 2016.

Osgood, R. (2005) The dead of Tormarton - Middle Bronze Age combat victims? In Parker Pearson, M. & Thorpe, I.J. (eds.) *Warfare, violence and slavery in prehistory: proceedings of a Prehistoric Society conference at Sheffield University*. BAR International Series 1374. Oxford: Archaeopress. 139-145.

Oswald, A. (1997) A doorway on the past: practical and mystic concerns in the orientation of roundhouse doorways. In Gwilt, A. & Haselgrove, C. (eds.) *Reconstructing Iron Age Societies*. Oxford: Oxbow. 87-95.

Parker Pearson, M. & Richards, C. (1994) Architecture and order: spatial representation and archaeology. In Parker Pearson, M. & Richards, C. (eds.) *Architecture and order: approaches to social space*. London: Routledge. 38-72.

Parker Pearson, M. (1996) Food, fertility and front doors in the first millennium BC. In Champion, T.C. & Collis, J.R. (eds.) *The Iron Age in Britain and Ireland: recent trends*. Sheffield: J.R. Collis Publications.

Petersson, M. (2008) Stone walls in west Östergötland - their dating and its consequences. In Chadwick, A.M. (ed.) *Recent approaches to the archaeology of land allotment*. BAR International Series 1875. Oxford: Archaeopress. 275-297.

Pigott, C.D & Pigott, M.E. (1963) Late-glacial and post-glacial deposits at Malham, Yorkshire. *New Phytologist* 62, 317-334.

Pryor, F. (2006) *Farmers in prehistoric Britain*. 2nd edition. Stroud: Tempus.

Quartermaine, J. & Leech, R. (2012) *Cairns, fields and cultivation: archaeological landscapes of the Lake District uplands*. Lancaster: Oxford Archaeology North.

Raistrick, A. (1937) Prehistoric cultivations at Grassington, West Yorkshire. *Yorkshire Archaeological Journal* 33, 166-174.

Raistrick, A. (1939) Iron Age settlements in West Yorkshire. *Yorkshire Journal of Archaeology* 34, 115-150.

Raistrick, A. (1948) *Grassington and Upper Wharfedale*. Dalesman Pocket Books Number 6. Lancaster: Dalesman.

Raistrick, A. (1968) *The Pennine Dales*. London: Eyre & Spottiswoode.

Raistrick, A. (1972) *Industrial archaeology: an historical survey*. London: Eyre Methuen.

Raistrick, A. & Chapman, S.E. (1929) The lynchet groups of Upper Wharfedale, Yorkshire. *Antiquity* 3(10), 165-181.

Raistrick, A. & Jennings, B. (1965) *A history of lead mining in the Pennines*. London: Longmans, Green & Co.

Reynolds, A.J. (2003) Boundaries and settlements in later 6th to 11th century England. In Griffiths, D., Reynolds, A.J. & Semple, S. (eds.) *Boundaries in Early Medieval Britain.* Anglo-Saxon Studies in Archaeology and History 12. Oxford: Oxford University School of Archaeology.

Riley, H. & Wilson-North, R. (2001) *The field archaeology of Exmoor*. Swindon: English Heritage.

Riley, D.N. (1980) *Early landscape from the air: studies of crop marks in South Yorkshire and North Nottinghamshire.* Sheffield: Sheffield University Department of prehistory and archaeology.

Roberts, I. (2008) Late prehistoric and Romano-British land division in South and West Yorkshire: an overview of the evidence. In Chadwick, A.M. (ed.) *Recent approaches to the archaeology of land allotment*. BAR International Series 1875. Oxford: Archaeopress. 185-203.

Roe, M. (2003) Lead mining archaeology in the Yorkshire Dales. *Landscapes* 1, 65-78.

Rowlands, M., Larsen, M. & Kristiansen, K. (eds.) (1987) *Centre and periphery in the ancient world*. Cambridge: Cambridge University Press.

Rushworth, G. (2010) *Late quaternary vegetation history of Craven, Yorkshire Dales*. Unpublished PhD thesis, University of Bradford.

Sauer, E.W. (2005) *Linear earthwork, tribal boundary and ritual beheading: Aves Ditch from the Iron Age to the Early Middle Ages*. BAR British Series 402. Oxford: Archaepress.

Sharples, N. (2010) *Social relations in later prehistory: Wessex in the first millennium BC*. Oxford: Oxford University Press.

Speight, E.E. (1894) Upper Wharfedale Exploration Committee. First annual report (1893). *Proceedings of the Yorkshire Geological and Polytechnic Society* 12, 374-384.

Speight, H. (1900) *Upper Wharfedale, being a complete account of the history, antiquities and scenery of the picturesque valley of the Wharfe, from Otley to Langstrothdale*. London: Elliot Stock.

Spek, T., Groenmann van-Waateringe, W., Kooistra, M. & Bakker, L. (2003) Formation and land-use history of Celtic fields in north-west Europe - an interdisciplinary case study at Zeijen, the Netherlands*. European Journal of Archaeology* 6(2), 141-173.

Spratt, D. (1981) Prehistoric boundaries on the North Yorkshire Moors. In Barker, G.W. (ed.) *Prehistoric communities in northern England*. Sheffield: Department of Prehistory and Archaeology University of Sheffield. 87-104.

Spratt, D. & Burgess, C. (eds.) (1985) *Upland settlement in Britain. The second millennium BC and after*. BAR British Series 143. Oxford: Archaeopress.

Swanton, M. (ed.) (2000) *The Anglo-Saxon Chronicles.* 2nd edition. London: Phoenix Press.

Taylor, T. (2001) Believing the ancients: quantitative and qualitative dimensions of slavery and the slave trade in later prehistoric Eurasia*. World Archaeology* 33(1), 27-43.

Taylor, T. (2011) Caves in context: research agendas for the underground environment. In Martlew, R.D. (ed.) *Prehistory in the Yorkshire Dales. Recent research and future prospects*. York: PLACE/YDLRT. 18-19.

Thorne, A. & Bennett, R. (2015) Secrets of the High Woods research agenda. South Downs National Park Authority. Last accessed 28th August 2016. Available online at https://www.southdowns.gov.uk/wp-content/uploads/2015/08/SHW_Research_Agenda.pdf

Thorpe, I.J. & Richards, C. (1984) The decline of ritual authority and the introduction of Beakers into Britain. In Bradley, R. & Gardiner, J. (eds.) *Neolithic studies. A review of some recent research*. BAR British Series 133. Oxford: Archaeopress. 67-84.

Tiddeman, R.H. (1875) *Third report of the Victoria Cave Exploration Committee.* London: British Association for the Advancement of Science.

Tilley, C. (1994) *A phenomenology of landscape: places, paths and monuments.* Explorations in anthropology. Oxford and Providence, RI: Berg.

Tilley, C. (2004) *The materiality of stone: explorations in landscape phenomenology*. Oxford: Berg.

Tilley, C. (2010) *Interpreting landscapes: geographies, topographies, identities.* Explorations in phenomenology 3. Walnut Creek: Left Coast Press.

Toms, H. (1911) The problem of ancient cultivations. *Antiquary* 47, 411-417.

Turner, T.E., Swindles, G.T. & Roucoux, K.H. (2014) Late Holocene ecohydrological and carbon dynamics of a UK raised bog: impact of human activity and climate change. *Quaternary Science Reviews* 84, 65-85.

van Giffen, A.E. (1928) Prehistoric fields in Holland. *Antiquity* 2, 85-87.

Vanzetti, A., Arnoldussen, S., Løvschal, M. & McOmish, D. (organisers) (2015) *Cropland shaping: the spread, function and social implications of field systems across Europe during pre- and proto-history*. Session AR3. Session at the 21st Annual Meeting of the European Association of Archaeologists, Glasgow, 2-5th September 2015.

Waltham, T. (2007) *The Yorkshire Dales. Landscape and geology*. Marlborough: Crowood Press.

Wheatley, D. & Gillings, M. (2002) *Spatial technology and archaeology. The archaeological applications of GIS.* London: Taylor & Francis.

White, R. (2002) Founders: Arthur Raistrick. *Landscapes* 2, 111-123.

Widgren, M. (1990) Strip fields in an Iron-Age context: a case study from Västergötland, Sweden. *Landscape History* 12(1), 5-24.

Whyte, I. (2003) *Transforming fell and valley. Landscape and parliamentary enclosure in North West England*. Lancaster: Centre for North-West Regional Studies.

Wickstead, H. (2008a) Land, landscape and Englishness in the discovery of prehistoric land division. In Chadwick, A.M. (ed.) *Recent approaches to the archaeology of land allotment*. BAR International Series 1875. Oxford: Archaeopress. 25-39.

Wickstead, H. (2008b) *Theorising tenure: land division and identity in later prehistoric Dartmoor, South-West Britain*. BAR British Series 465. Oxford: Archaeopress.

Widgren, M. (1998) Strip fields in an Iron-Age context: a case study from Västergötland, Sweden. *Landscape History* 12(1), 5-24.

Williams, M. (2010) *Prehistoric belief: shamans, trance and the afterlife*. Stroud: History Press.

Williamson, T. (1986) Parish boundaries and early fields: continuity and discontinuity. *Journal of Historical Geography* 12(3), 241-248.

Williamson, T. (1987) Early co-axial field systems on the East Anglian boulder clays. *Proceedings of the Prehistoric Society* 53, 419-32.

Williamson, T. (1998) The ‘Scole-Dickleborough field system’ revisited. *Landscape History* 20, 19-28.

Yates, D. (1999) Bronze Age field systems in the Thames Valley. *Oxford Journal of Archaeology* 18(2), 157-170.

Yates, D. (2007) *Land, power and prestige. Bronze Age field systems in Southern England*. Oxford: Oxbow.

Yates, D. (2012) Landscape edges: directions for Bronze Age field systems. In Jones, A.M., Pollard, J., Allen, M.J. & Gardiner, J. (eds.) *Image, memory and monumentality*. *Archaeological engagements with the material world: a celebration of the adademic achievements of Professor Richard Bradley.* Prehistoric Society Research Paper Number 5. Oxford & Oakville: The Prehistoric Society. 289-102.

YDLRT (Yorkshire Dales Landscape Research Trust) *2013 High Close Survey* Last accessed 20th June 2014. Available online at http://www.ydlrt.co.uk/high_close/high_close.html

YDNPA (Yorkshire Dales National Park Authority) (2015) *National Park Management Plan 2013-2018*. *Annual report June 2015*. Last accessed 8th September 2016. Available online at http://www.yorkshiredalesmanagementplan.org.uk/__data/assets/pdf_file/0004/584518/annual-report-2015.pdf

Appendix 1: Catalogue of known Coaxial Field Systems of the Yorkshire Dales

This appendix catalogues details of 24 later prehistoric coaxial field systems that have been identified within the Yorkshire Dales National Park. In the process of indexing the systems, it became apparent that a number of decisions (relating to, for example, the extent of the original systems, the elements that constitute a system, and the degree of archaeological survival) would have to be made that could appear, at best, arbitrary. These have duly been made here, but their limitations are recognised; particularly problematic are the division of (what are understood as) multiple systems in a given area - such as Carperby ‘1’ and ‘2’ - the separation of which may have more to do with destructive land use processes than original layout, and the relationships between which are usually unknown. In the case of the Wharfedale systems, the previously assigned (Horne & MacLeod 1995) system names have been retained, albeit with some modification. Likewise, if the naming conventions used (taking modern place names as a basis) suggest too strong a subliminal tie to modern geographical features, they do so in order to increase clarity (compared with, for example, a numbered system).

Individual systems are grouped here by dale and ordered within this by location, working down the valley from the upper extent. Only systems within the national park are included. Remains which cannot be corroborated with any degree of confidence either as prehistoric or a full system, but which are historically recorded as a prehistoric coaxial system by the Historic Environment Record or the National Mapping Pilot Project are included in Appendix 2 with the caveat of ‘possible’ coaxial system. Each entry contains the HER and NMPP record numbers where appropriate, as well as any relevant external references.

Middlesmoor Pasture	
Centred On	396423 471947
Civil Parish	Kettlewell with Starbotton
HER ID	MYD4172
YDMP ID	-
References	Raistrick Collection 1407B
Location	Eastern flank of Knipe Hill, a spur separating Wharfedale and Littondale; overlooking the village of Kettlewell.
Geology	Garsdale and Danny Bridge limestone formations. Abundant sinkholes. Evidence of historic mineral working near by.
Current land use	Rough Pasture
Aspect	NE/E facing
Axial direction (modal)	63º
Minimum elevation	295m aOD
Maximum elevation	420m aOD
Approx. area	39ha
Approx. width (along contour)	1170m
Approx. length (in axial direction)	420m
Total length of boundaries	1423m
Number of boundary fragments	32
Mean length of boundary fragment (range)	42m (9-86m)
Transverse boundaries	Possible use of natural scars
Terminal boundaries	Possible use of natural scars
Median distance between axials	46m
Relationship to other systems	Directly across the valley from GK1
Associated features	Cairns of unknown date (MYD53342, MYD53359), small enclosures of possible prehistoric date (e.g. MYD53340, MYD4172, MYD55332).

Grassington-Kettlewell 1	
Centred On	396425 471975
Civil Parish	Kettlewell with Starbotton
HER ID	MYD4172
YDMP ID	NY.999.1.1
References	Horne & MacLeod 1995
Location	Southeast of Kettlewell, running along Scar Top.
Geology	Great Scar and Alston limestone, Yoredale series rocks and Grassington Grit further up the hillside. Abundant sinkholes. Evidence of historic mineral working near by.
Current land use	Rough pasture
Aspect	W/SW facing
Axial direction (modal)	85º
Minimum elevation	285m aOD
Maximum elevation	440m aOD
Approx. area	102ha
Approx. width (along contour)	2km
Approx. length (in axial direction)	850m
Total length of boundaries	3708m
Number of boundary fragments	103
Mean length of boundary fragment (range)	36m (8-167m)
Transverse boundaries	Possible use of natural scars
Terminal boundaries	Possible natural lower terminal
Median distance between axials	50m
Relationship to other systems	Unknown relationship to GK-2, 800m to the south. Directly across the valley from Middlesmoor Pasture.
Associated features	Small enclosures and well-defined rubble/earthwork hut remains (e.g. MYD53340); flint artefacts (MYD4176, MYD4183, MYD50612); cairn (MYD53342).

Grassington-Kettlewell 2	
Centred On	398780 469745
Civil Parish	Kettlewell with Starbotton, Conistone with Kilnsey
HER ID	MYD39270
YDMP ID	NY.1123.551
References	Horne & MacLeod 1995; Horne & MacLeod 2001
Location	South of Kettlewell, located along the top of Swineber Scar
Geology	Great Scar and Alston limestone, Yoredale series rocks and Grassington Grit further up the hillside. Abundant sinkholes. Evidence of historic mineral working near by.
Current land use	Rough pasture
Aspect	SW/W facing
Axial direction (modal)	64º
Minimum elevation	305m aOD
Maximum elevation	415m aOD
Approx. area	92ha
Approx. width (along contour)	1.8km
Approx. length (in axial direction)	820m
Total length of boundaries	5884m
Number of boundary fragments	103
Mean length of boundary fragment (range)	57m (12-342m)
Transverse boundaries	Possible use of natural scars; possible artificial boundary
Terminal boundaries	Possible natural lower terminal
Median distance between axials	55m
Relationship to other systems	Unknown relationship to G-K 1 to the north and G-K 3 to the south; possibly relates to droveway of unknown date to south (separation from G-K 3).
Associated features	Possible prehistoric settlement (MYD4171).

Grassington-Kettlewell 3	
Centred On	399155 47255
Civil Parish	Conistone with Kilnsey
HER ID	MYD1656
YDMP ID	NY.1123.21.1
References	Horne & MacLeod 1995; Horne & MacLeod 2001
Location	South of Kettlewell, above Hill Castles Scar on the southern part of New Close Allotments. of Conistone Dib; between Conistone Dib to the south and the natural break in the scar line to the north.
Geology	Great Scar and Alston limestone, Yoredale series rocks and Grassington Grit further up the hillside. Abundant sinkholes. Evidence of historic mineral working near by.
Current land use	Rough pasture
Aspect	SW/S facing
Axial direction (modal)	39º
Minimum elevation	320m aOD
Maximum elevation	385m (with an outlier reaching 490m aOD)
Approx. area	64ha
Approx. width (along contour)	660m
Approx. length (in axial direction)	2170m
Total length of boundaries	4808m
Number of boundary fragments	55
Mean length of boundary fragment (range)	87m (12-670m)
Transverse boundaries	Possible use of natural scars
Terminal boundaries	Unclear
Median distance between axials	59m
Relationship to other systems	Separated from GK-2 by droveway; difficult to separate from GK-4 due to area of limestone pavement. Southernmost axial is particularly long (and aligned on sinkhole).
Associated features	Possible settlement (e.g. MYD4171); probable cairns (MYD1677).

Grassington-Kettlewell 4	
Centred On	399255 468045
Civil Parish	Conistone with Kilnsey
HER ID	MYD4022
YDMP ID	NY.1121.16.2
References	Horne & MacLeod 1995; Horne & MacLeod 2001
Location	Immediately east of Conistone Dib, covering the northern extent of Old Pasture.
Geology	Great Scar and Alston limestone, Yoredale series rocks and Grassington Grit further up the hillside. Abundant sinkholes. Evidence of historic mineral working near by.
Current land use	Rough pasture
Aspect	SW/S facing
Axial direction (modal)	36º
Minimum elevation	305m aOD
Maximum elevation	370m aOD
Approx. area	66ha
Approx. width (along contour)	1000m
Approx. length (in axial direction)	1120m
Total length of boundaries	7783m
Number of boundary fragments	129
Mean length of boundary fragment (range)	65m (6 - 588m)
Transverse boundaries	Use of natural scar; additional artificial boundaries.
Terminal boundaries	None visible
Median distance between axials	40m
Relationship to other systems	Possibly related to G-K4a (with direction change of axials). Uncertain relationship to G-K5 to the south (slightly different axial angle).
Associated features	Settlement enclosures; early bronze age burial cairn (MYD4025).

Grassington-Kettlewell 4a	
Centred On	398805 467435
Civil Parish	Conistone with Kilnsey
HER ID	-
YDMP ID	(part of NY.1121.16.2)
References	Horne & MacLeod 1995
Location	Old Pasture, above the village of Conistone
Geology	Great Scar and Alston limestone
Current land use	Rough pasture
Aspect	SW?E facing
Axial direction (modal)	51º
Minimum elevation	225m aOD
Maximum elevation	330m aOD
Approx. area	92ha
Approx. width (along contour)	1180m
Approx. length (in axial direction)	1020m
Total length of boundaries	2719m
Number of boundary fragments	43
Mean length of boundary fragment (range)	51m (2 - 308m)
Transverse boundaries	None visible
Terminal boundaries	Possible natural lower terminal
Median distance between axials	36.5m
Relationship to other systems	Possibly related to G-K4a (with direction change of axials) (Horne & MacLeod 1995).
Associated features	Possible prehistoric enclosures, lithic finds, cairns (MYD4051, MYD4052).

Grassington-Kettlewell 5	
Centred On	400150 467120
Civil Parish	Conistone with Kilnsey, Grassington
HER ID	MYD41783
YDMP ID	NY.955.1.1
References	Horne & MacLeod 1995
Location	On eastern side of topographic 'bowl' north of Grassington.
Geology	Great Scar and Alston limestone, Yoredale series rocks and Grassington Grit further up the hillside. Abundant sinkholes. Evidence of historic mineral working near by.
Current land use	Rough pasture
Aspect	W/SW facing
Axial direction (modal)	46º
Minimum elevation	240m aOD
Maximum elevation	365m aOD
Approx. area	53ha
Approx. width (along contour)	1560m
Approx. length (in axial direction)	740m
Total length of boundaries	6099m
Number of boundary fragments	61
Mean length of boundary fragment (range)	100m (21 - 329m)
Transverse boundaries	None visible
Terminal boundaries	None visible (downslope extent possibly truncated)
Median distance between axials	35m
Relationship to other systems	Difficult to differentiate between G-K 5 and GK 4 to north and G-K 6 to south.
Associated features	Enclosures of probable prehistoric date (MYD41790, MYD41792, MYD41793 etc); round barrow (MYD54027).

Grassington-Kettlewell 6	
Centred On	400200 465500
Civil Parish	Grassington
HER ID	MYD4028
YDMP ID	NY.955.2.1
References	Horne & MacLeod 1995; Raistrick 1937; Annotated OS Air Machine Plan (Raistrick Collection).
Location	Immediately north of Grassington, on the pastures of Sweetside, Lea Green, Capstick Pasture and High Close Pasture, to the south of G-K System 5.
Geology	Great Scar limestone, overlain by till in places, Yoredale series rocks and Grassington Grit further up the hillside. Abundant sinkholes. Evidence of historic mineral working near by.
Current land use	Rough pasture
Aspect	S/SW facing
Axial direction (modal)	48º
Minimum elevation	220m aOD
Maximum elevation	345m aOD
Approx. area	156ha
Approx. width (along contour)	1900m
Approx. length (in axial direction)	1500m
Total length of boundaries	23 805m
Number of boundary fragments	412
Mean length of boundary fragment (range)	58m (2-349m)
Transverse boundaries	Artificial
Terminal boundaries	Possible use of natural scar
Median distance between axials	35.5m
Relationship to other systems	Difficult to differentiate with G-K 5 to the north
Associated features	Lithic finds. Burial/probable cairns (MYD4032, MYD36697, MYD43348, MYD41853, MYD4381).

Kilnsey 1	
Centred On	394855 468215
Civil Parish	Conistone with Kilnsey
HER ID	MYD1167
YDMP ID	NY.1118.50.1
References	n/a
Location	Kilnsey Moor, on the western side of Wharfedale, above Kilnsey Crag and quarry; located on the western slopes of the topographic 'bowl' created by Howgill.
Geology	Garsdale and Danny Bridge limestone, overlain by till on lower slopes; evidence for historical mineral working.
Current land use	Rough pasture.
Aspect	S/SE facing
Axial direction (modal)	137º
Minimum elevation	365m aOD
Maximum elevation	455m aOD
Approx. area	19ha
Approx. width (along contour)	400m
Approx. length (in axial direction)	780m
Total length of boundaries	1590m
Number of boundary fragments	26
Mean length of boundary fragment (range)	44m (3 - 174m)
Transverse boundaries	Artificial
Terminal boundaries	Natural scar upper terminal
Median distance between axials	56m
Relationship to other systems	Relationship to nearby systems Kilnsey 2 and Kilnsey 3 unknown.
Associated features	Cairn (MYD4019), Dowkerbottom Cave (MYD4015), Bronze Age ring cairn (MYD53442), enclosure (MYD1175).

Kilnsey 2	
Centred On	394980 467490
Civil Parish	Conistone with Kilnsey, Hawkswick
HER ID	MYD1167
YDMP ID	NY.1118.26.1
References	n/a
Location	Kilnsey Moor, on the western side of Wharfedale, above Kilnsey Crag and quarry; located on the western slopes of the topographic 'bowl' created by Howgill.
Geology	Garsdale and Danny Bridge limestone, overlain by till on lower slopes; evidence for historic mineral working near by. Abundant sink holes.
Current land use	Rough Pasture
Aspect	NE/E facing
Axial direction (modal)	58º
Minimum elevation	345m aOD
Maximum elevation	465m aOD
Approx. area	86ha
Approx. width (along contour)	720m
Approx. length (in axial direction)	1050m
Total length of boundaries	2078m
Number of boundary fragments	20
Mean length of boundary fragment (range)	104m (2-251m)
Transverse boundaries	Natural and artificial
Terminal boundaries	Artificial upper terminal
Median distance between axials	52.5m
Relationship to other systems	A group of 21 boundary fragments (covering approx. 26ha; c.650 x 690m) lie approx. 1km southeast of this system and, sharing some elements of axial direction with the larger group and may be part of it, although medieval boundaries are also visible in this area. Relationship to nearby systems Kilnsey 1 and Kilnsey 3 unknown.
Associated features	Clearance cairn (MYD39111); enclosures (MYD39103, MYD39106); building platforms (MYD1169).

Littondale

Halton Gill	
Centred On	387850 475850
Civil Parish	Halton Gill
HER ID	MYD38585, MYD3848, MYD25518
YDMP ID	NY.1049.1.2, NY.1049.1.1, NY.1049.2.1, NY.1049.22.1
References	Maude 1998
Location	On the western side of Upper Littondale opposite the village of Halton Gill.
Geology	Danny Bridge and Alston limestones, overlain by till on the lower slopes.
Current land use	Rough pasture
Aspect	NE/E facing
Axial direction (modal)	59º
Minimum elevation	325m aOD
Maximum elevation	405m aOD
Approx. area	39ha
Approx. width (along contour)	1730m
Approx. length (in axial direction)	410m
Total length of boundaries	2980m
Number of boundary fragments	34
Mean length of boundary fragment (range)	88m (13 - 133m)
Transverse boundaries	Possible use of natural scars
Terminal boundaries	None visible
Median distance between axials	55.5m
Relationship to other systems	Unknown relationship to other systems in the valley
Associated features	Romano-British settlement (38589), enclosure (MYD38590), clearance cairns (MYD38591).

Cowside Beck	
Centred On	391500 471915
Civil Parish	Arncliffe
HER ID	MYD38970
YDMP ID	-
References	n/a
Location	West Moor Pasture, on western side of Littondale, west of the village of Arncliffe
Geology	Danny Bridge and Garsdale limestones
Current land use	Rough grazing
Aspect	NE/E facing
Axial direction (modal)	48º
Minimum elevation	335m aOD
Maximum elevation	435m aOD
Approx. area	48ha
Approx. width (along contour)	850m
Approx. length (in axial direction)	700m
Total length of boundaries	2228m
Number of boundary fragments	23
Mean length of boundary fragment (range)	97m (14 - 470m)
Transverse boundaries	Possible use of natural scars
Terminal boundaries	Possible natural lower terminal
Median distance between axials	119m
Relationship to other systems	Directly across the valley from Arncliffe system. Unknown relationship with Halton Gill.
Associated features	Settlement evidence/IA/RB fields (MYD4192); probable medieval fields and holloway (54592), enclosures (MYD38971).

Arncliffe	
Centred On	392950 472780
Civil Parish	Hawkswick
HER ID	MYD38955
YDMP ID	NY.1096.1.1
References	n/a
Location	Old Cote Moor, eastern side of Littondale, northeast of the village of Arncliffe.
Geology	Garsdale and Danny Bridge limestone, with bands of Yoredale sandstones outcropping on the upper valley sides.
Current land use	Rough Pasture
Aspect	SW/S facing
Axial direction (modal)	40º
Minimum elevation	285m aOD
Maximum elevation	390m aOD
Approx. area	17ha
Approx. width (along contour)	440m
Approx. length (in axial direction)	520m
Total length of boundaries	1348m
Number of boundary fragments	39
Mean length of boundary fragment (range)	35m (6 - 121m)
Transverse boundaries	Possible use of natural scars
Terminal boundaries	Possible natural lower terminal
Median distance between axials	40m
Relationship to other systems	Directly across valley from Cowside Beck system. Unknown relationship with others nearby.
Associated features	Cairns, scooped settlement platforms (MYD55510).

Ribblesdale

Horton	
Centred On	378880 473705
Civil Parish	Horton in Ribblesdale
HER ID	-
YDMP ID	-
References	n/a
Location	The Sulber pasture, on the western side of Ribblesdale, northwest of Horton-in-Ribblesdale. ‘Contained’ by Sulber Nick.
Geology	Danny Bridge limestone
Current land use	Rough pasture
Aspect	E/NE facing
Axial direction (modal)	79º
Minimum elevation	265m aOD
Maximum elevation	360m aOD
Approx. area	49ha
Approx. width (along contour)	850m
Approx. length (in axial direction)	700m
Total length of boundaries	2173m
Number of boundary fragments	43
Mean length of boundary fragment (range)	36m (2 - 287m)
Transverse boundaries	Possible use of natural scars
Terminal boundaries	Possible use of natural scars
Median distance between axials	93.5m
Relationship to other systems	Unknown relationship to other systems in the dale.
Associated features	Clearance cairns, ?IA/RB settlement (MYD3695), building platforms (MYD59578).

Stainforth	
Centred On	383450 466360, 382540 467150
Civil Parish	Stainforth
HER ID	MYD40104
YDMP ID	NY.1238.9.1
References	n/a
Location	Southeast of Stainforth in mid-Ribblesdale, on Winskill Stones and the top of Stainforth Scar (system is in two parts).
Geology	Kilnsey, Garsdale and Danny Bridge limestone, partially covered by till.
Current land use	Rough pasture
Aspect	NW/N facing
Axial direction (modal)	78º
Minimum elevation	290m aOD
Maximum elevation	370m aOD
Approx. area	38ha
Approx. width (along contour)	430m
Approx. length (in axial direction)	860m
Total length of boundaries	3160m
Number of boundary fragments	25
Mean length of boundary fragment (range)	126m (19 - 675m)
Transverse boundaries	Possible use of natural scars
Terminal boundaries	Possible use of natural scars
Median distance between axials	53.5m
Relationship to other systems	Unknown relationship to other systems in the dale.
Associated features	Possible prehistoric enclosures (MYD40087, MYD40088), glacial erratics.

Settle	
Centred On	382410 464680
Civil Parish	Langcliffe
HER ID	-
YDMP ID	NY.1237.13.1
References	n/a
Location	Northeast of Settle in mid-Ribblesdale; west of Blua Crags.
Geology	Garsdale and Danny Bridge limestone, partially covered by till.
Current land use	Rough pasture
Aspect	W/NW facing
Axial direction (modal)	104º
Minimum elevation	190m aOD
Maximum elevation	370m aOD
Approx. area	68ha
Approx. width (along contour)	1.3km
Approx. length (in axial direction)	600m
Total length of boundaries	5207
Number of boundary fragments	44
Mean length of boundary fragment (range)	61m (4 - 371m)
Transverse boundaries	Possible use of natural scars
Terminal boundaries	Possible use of natural scars
Median distance between axials	55m
Relationship to other systems	Unknown relationship to other systems in the dale.
Associated features	Jubilee, Victoria and Attermire Caves nearby; building platform; runs into Medieval field system (MYD55407).

Wensleydale

Carperby 1	
Centred On	399060 490180
Civil Parish	Carperby-cum-Thoresby
HER ID	MYD35003
YDMP ID	NY.738.18.1
References	n/a
Location	Ox Close Pasture on north side of mid-Wensleydale. Site possibly truncated by historic lead mining activity.
Geology	Middle limestone with outcrops of Yoredale series sandstones higher upslope.
Current land use	Rough pasture
Aspect	NW/W facing
Axial direction (modal)	176º
Minimum elevation	280m aOD
Maximum elevation	350m aOD
Approx. area	17ha
Approx. width (along contour)	570m
Approx. length (in axial direction)	410m
Total length of boundaries	922m
Number of boundary fragments	11
Mean length of boundary fragment (range)	84m (16 - 253m)
Transverse boundaries	None visible
Terminal boundaries	Possible use of natural scars
Median distance between axials	115m
Relationship to other systems	Directly across the valley from West Burton system. Unknown relationship with Carperby 2 (possibly part of the same system?)
Associated features	Enclosed cremation cemetery (MYD4264).

Carperby 2	
Centred On	400750 491250
Civil Parish	Carperby-cum-Thoresby
HER ID	-
YDMP ID	NY.738.6.1
References	n/a
Location	Approx. 2km east of Carperby 1 on the north side of Wensleydale above the village of Carperby.
Geology	Alston limestone with subordinate sandstone and argillaceous rocks, with outcrops of other limestones and Yoredale sandstone
Current land use	Rough pasture
Aspect	S/W facing
Axial direction (modal)	125º
Minimum elevation	290m aOD
Maximum elevation	330m aOD
Approx. area	9ha
Approx. width (along contour)	1240m
Approx. length (in axial direction)	540m
Total length of boundaries	2284m
Number of boundary fragments	34
Mean length of boundary fragment (range)	67m (9-370)
Transverse boundaries	None visible
Terminal boundaries	Possible use of natural scars
Median distance between axials	56m
Relationship to other systems	Directly across the valley from West Burton. Unknown relationship with Carperby 1 (possibly part of the same system?).
Associated features	Possible clearance cairns (MYD47874).

West Burton 1	
Centred On	403040 486870
Civil Parish	Burton-cum-Walden
HER ID	MYD57743, MYD49584
YDMP ID	NY.935.6.1, NY.935.6.2
References	n/a
Location	On the eastern side of Bishopdale, at its mouth and confluence with Wensleydale, above the village of West Burton.
Geology	Yoredale series with outcrops of other limestones and Yoredale sandstone.
Current land use	Rough pasture
Aspect	E/SE facing
Axial direction (modal)	133º
Minimum elevation	315m aOD
Maximum elevation	390m aOD
Approx. area	31ha
Approx. width (along contour)	975m
Approx. length (in axial direction)	470m
Total length of boundaries	2018m
Number of boundary fragments	33
Mean length of boundary fragment (range)	65m (25 - 149m)
Transverse boundaries	None visible
Terminal boundaries	Possible use of natural scars
Median distance between axials	60m
Relationship to other systems	Directly across the valley from Carperby 1 and 2.
Associated features	Cairn (MYD57735), burnt mounds (MYD37117), building platform (MYD57734).

Swaledale

Low Row Pasture	
Centred On	396825 498120
Civil Parish	Melbecks
HER ID	MYD4251
YDMP ID	-
References	Laurie *et al.* 2011
Location	On Barf Side, approximately 1km west of the hamlet of Riddings and opposite the hamlet of Crackpot.
Geology	Alston limestone, sandstone, siltstone and mudstone, with outcrops of Middle limestone, overlain immediately upslope by Alston sandstone and peat; evidence of historic mineral working nearby.
Current land use	Rough pasture.
Aspect	S/SE facing
Axial direction (modal)	169º
Minimum elevation	375m aOD
Maximum elevation	390m aOD
Approx. area	6ha
Approx. width (along contour)	440m
Approx. length (in axial direction)	180m
Total length of boundaries	479m
Number of boundary fragments	14
Mean length of boundary fragment (range)	34m (10 -62m)
Transverse boundaries	None visible
Terminal boundaries	Possible lower boundary scar
Median distance between axials	26m
Relationship to other systems	Unknown relationship with other systems in the dale.
Associated features	Lithic find (MYD59279), ?late Neolithic barrow (MYD58742).

Healaugh	
Centred On	400680 500050
Civil Parish	Reeth, Fremington and Healaugh
HER ID	MYD36698
YDMP ID	NY.611.1.2, NY.674.8.1
References	Laurie *et al.* 2011; Fleming 2010
Location	Southern slopes of Cringley Hill and Calver Hill, north and northwest of the village of Healaugh in mid Swaledale; extending east from Cringley Bottom, the system overlooks Barney Beck, a tributary of the Swale.
Geology	Alston limestone with subordinate sandstone, with outcrops of Middle and Simonstone limestones and Alston sandstone
Current land use	Heather moorland
Aspect	S/SW facing
Axial direction (modal)	21º
Minimum elevation	320m aOD
Maximum elevation	425m aOD
Approx. area	141ha
Approx. width (along contour)	2970m
Approx. length (in axial direction)	590m
Total length of boundaries	10 227m
Number of boundary fragments	93
Mean length of boundary fragment (range)	110m (8 - 535m)
Transverse boundaries	Artificial boundaries
Terminal boundaries	Stepped artificial upper boundary
Median distance between axials	104m
Relationship to other systems	Axial boundary overlies axial of the Reeth system. Fleming suggests the system was in position by 300BC (Fleming 2010: 145).
Associated features	Abundant clearance cairn fields (e.g. MYD55031), burnt mounds (e.g. MYD37271), settlement remains (e.g. MYD46064), lithic finds, large cairn (MYD2486).

Reeth Low Moor	Reeth Low Moor
Centred On	402460 500010
Civil Parish	Reeth, Fremington and Healaugh
HER ID	MYD36698, MYD50521
YDMP ID	NY.611.7.1
References	Laurie *et al*. 2011; Fleming 2010
Location	On Reeth Low Moor, occupying spur between Swaledale and Arkengarthdale.
Geology	Alston limestone with outcrops of Middle limestone and Alston sandstone
Current land use	Heather moorland
Aspect	NE/E facing
Axial direction (modal)	129º
Minimum elevation	265m aOD
Maximum elevation	415m aOD
Approx. area	102ha
Approx. width (along contour)	1500m
Approx. length (in axial direction)	930m
Total length of boundaries	Phase 1: 1051m, Phase 2: 6804
Number of boundary fragments	Phase 1: 6, Phase 2: 63
Mean length of boundary fragment (range)	Phase 1: 175m (60 - 359m), Phase 2: 108m (11 - 523m)
Transverse boundaries	Artificial boundaries
Terminal boundaries	Artificial upper terminal
Median distance between axials	95m
Relationship to other systems	Phase 2 wall overlain by wall of the Healaugh System. Directly across the valley from Harkerside system.
Associated features	Burnt mounds, enclosures (MYD46806).

Harkerside	
Centred On	403370 497700
Civil Parish	Grinton
HER ID	MYD37585, MYD4515, MYD48246
YDMP ID	NY.778.68.2, NY.778.68.1
References	Laurie *et al.* 2011; Fleming 2010.
Location	Southern side of mid-Swaledale, above the village of Reeth.
Geology	Alston and other limestones with subordinate sandstone
Current land use	Heather moorland
Aspect	N/NE facing
Axial direction (modal)	31º
Minimum elevation	205m aOD
Maximum elevation	390m aOD
Approx. area	86ha
Approx. width (along contour)	2250m
Approx. length (in axial direction)	650m
Total length of boundaries	13 058m
Number of boundary fragments	179
Mean length of boundary fragment (range)	71m (2 - 703m)
Transverse boundaries	Artificial boundaries
Terminal boundaries	Artificial upper
Median distance between axials	73m
Relationship to other systems	Possibly part of Grinton Moor system? Directly across the dale from Reeth and Harkerside systems.
Associated features	Maiden Castle (MYD4503), linear earthworks (MYD4517, MYD4516), lithic finds, ?stone circle (MYD4515), burnt mounds (e.g. MYD37262), cairns (e.g. MYD48281).

Grinton Moor	
Centred On	404400 497140
Civil Parish	Grinton
HER ID	Part of MYD37585
YDMP ID	Part of NY.778.68.2, NY.778.68.1
References	Laurie *et al.* 2011; Fleming 2010.
Location	Between Grinton and Cogden Becks, above the village of Grinton on the southern side of mid Swaledale.
Geology	Alston and other limestones with subordinate sandstone
Current land use	Heather moorland
Aspect	NE/N facing
Axial direction (modal)	24º
Minimum elevation	240m aOD
Maximum elevation	410m aOD
Approx. area	104ha
Approx. width (along contour)	1600m
Approx. length (in axial direction)	900m
Total length of boundaries	9326m
Number of boundary fragments	48
Mean length of boundary fragment (range)	356m (3 - 841m)
Transverse boundaries	Artificial boundaries
Terminal boundaries	None visible
Median distance between axials	116m
Relationship to other systems	Possibly part of Harkerside system?
Associated features	Cairns, burnt mounds (e.g. MYD37263), lithic finds.

Appendix 2: Catalogue of possible coaxial field systems of the Yorkshire Dales

This appendix catalogues details of 18 further possible later prehistoric coaxial field systems that have been identified at some point within the Yorkshire Dales National Park but which have not been included in the analyses here as too little evidence exists to identify them as such with confidence or to apply mapping techniques etc. The majority originated as HER records but evidence was not visible on the available aerial imagery and/or on the ground when investigated for this study, so they have been tentatively categorized as 'possible' coaxial systems.

Wharfedale

Starbotton	
Centred On	396890 472760
Civil Parish	Kettlewell with Starbotton
HER ID	MYD41719, MYD4173
YDMP ID	-
Location	On the lower slopes of the eastern side of Wharfedale, approx. 400m southeast of the village of Starbotton.
Geology	Danny Bridge and Alston limestone
Current land use	Rough pasture
Aspect	SW facing
Approx. elevation	c.200m aOD
Description	Recorded as possible boundaries in HER. Not visible on available aerial imagery.

Kilnsey 3	
Centred On	395760 467970
Civil Parish	Conistone with Kilnsey
HER ID	MYD39112
YDMP ID	NY.1116.9.1
Location	Located on High Ox Pasture, the eastern side of the shallow ‘bowl’ that forms the Howgill tributary valley, joining Wharfedale immediately south of the village of Kilnsey.
Geology	Garsdale limestone overlain by till
Current land use	Rough pasture
Aspect	West
Approx. elevation	c.330m aOD.
Description	Some possible evidence of fragmentary boundaries on aerial imagery. Impossible to distinguish from probable medieval boundaries in this area.

Chapel House Wood	
Centred On	397695 465450
Civil Parish	Conistone with Kilnsey
HER ID	MYD39161
YDMP ID	-
Location	On the lower slopes of the western side of Wharfedale, below Threshfield Quarry, overlooking Grass Wood.
Geology	Garsdale and Great Scar limestones
Current land use	Rough pasture
Aspect	East
Approx. elevation	c.250m aOD.
Description	Not visible on available aerial imagery.

Appletreewick	
Centred On	405130 462050
Civil Parish	Appletreewick
HER ID	MYD37613, MYD37605, MYD37616, MYD37614
YDMP ID	-
Referernces	Cardwell *et al*. 1990
Location	Appletreewick Pasture, on the eastern bank of Barbon Beck (a tributary of the Wharfe), north of the village of Appletreewick.
Geology	Pendleside limestone overlain by till
Current land use	Rough pasture
Aspect	West
Approx. elevation	c.250m aOD.
Description	Several boundaries excavated ahead of pipeline construction, three of which were visible on the surface prior to excavation. One boundary aligned with a small sinkhole. Clearance cairns, a ring cairn and ploughmarks were also excavated. Possibly part of a coaxial system, but the wider layout of any field system is not apparent due to the narrow width of the investigated corridor.

Littondale

Flats Barn	
Centred On	396 472478
Civil Parish	Arncliffe
HER ID	MYD59416
YDMP ID	-
Location	Close to Byre bank wood, below the lower scar on the northern side of Littondale, northeast of the village of Arncliffe.
Geology	Garsdale limestone overlain by till
Current land use	Rough pasture
Aspect	SW facing
Approx. elevation	c.200m aOD
Description	Noted during stewardship survey. 6 field banks mostly running up/downslope, associated with one well-defined building platform.

Hawkswick	
Centred On	396345 469215
Civil Parish	Hawkswick
HER ID	MYD36321, MYD39010
YDMP ID	-
Location	On the southern side of Littondale at its confluence with Wharfedale.
Geology	Garsdale limestone overlain by till
Current land use	Rough pasture
Aspect	NE facing
Approx. elevation	c.250m aOD
Description	A number of coaxial boundaries running up/downslope; probably medieval.

Malham

Malham 1	
Centred On	389388 463883
Civil Parish	Malham
HER ID	MYD54733
YDMP ID	NY.1146.6.1
Location	At the southwestern extent of the natural amphitheatre formed by Malham Cove, approx. level with the top of the Cove.
Geology	Garsdale limestone
Current land use	Rough pasture
Aspect	SE facing
Approx. elevation	c.300m aOD
Description	Part of a more extensive field system extending across the area. Intricately linked with medieval boundaries.

Malham 2	
Centred On	390140 464035
Civil Parish	Malham
HER ID	MYD4141
YDMP ID	NY1142.23.1
Location	East of Malham Cove.
Geology	Danny Bridge limestone
Current land use	Rough pasture
Aspect	SW facing
Approx. elevation	c.330m aOD
Description	Part of a more extensive field system extending across the area. Intricately linked with medieval boundaries. Rectangular fields rather than coaxial strips.

Malham 3	
Centred On	391046 464157
Civil Parish	Malham
HER ID	MYD39358
YDMP ID	NY1142.9.1
Location	On New Close Knotts, above Gordale Beck.
Geology	Garsdale limestone
Current land use	Rough pasture
Aspect	SE facing
Approx. elevation	c.350m aOD
Description	Rectangular fields. Part of a more extensive field system extending across the area. Intricately linked with medieval boundaries.

Wensleydale

Thoralby	
Centred On	399763 486823
Civil Parish	Thoralby
HER ID	MYD45877
YDMP ID	NY.480.72.1, NY480.73.1
Location	On the west side of Bishopdale, above the village of Thoralby.
Geology	Yoredale series (undifferentiated)
Current land use	Rough pasture
Aspect	SE facing
Approx. elevation	c.250m aOD
Description	Recorded on HER; not visible on available aerial imagery or on the ground at time of visit.

West Witton	
Centred On	406020 487587
Civil Parish	West Witton
HER ID	MYD53592
YDMP ID	-
Location	Penhill Park, above the village of West Witton on the southern side of Wensleydale
Geology	Middle limestone
Current land use	Rough pasture
Aspect	N facing
Approx. elevation	c.300m aOD
Description	Described in the HER as a series of small lynchets possibly forming a coaxial field system.

Caldbergh	
Centred On	410986 485011
Civil Parish	Caldbergh with East Scrafton
HER ID	MYD58656
YDMP ID	-
Location	On Caldbergh Pasture, the northern extent of Braithwaite Moor.
Geology	Mill stone grit
Current land use	Rough pasture
Aspect	NW facing
Approx. elevation	c. 300m aOD.
Description	Not apparent on aerial imagery or on the ground due to heather cover. Surveyed by T. Laurie. Incorporates a ring cairn and smaller cairns. Details not available. Close to the univallate 'hillfort' of Castle Steads.

Swaledale

Satronside	
Centred On	394347 497367
Civil Parish	Muker
HER ID	MYD56163
YDMP ID	-
Location	Above the hamlet of Satron, on Satronside (southern side of Swaledale)
Geology	Alston and Simonstone limestone with subsidiary sandstone
Current land use	Rough pasture
Aspect	N facing
Approx. elevation	c.350m aOD
Description	Described in the HER as very faint, only visible in optimal light conditions. Not apparent on the available aerial imagery or on the ground.

Gunnerside	
Centred On	394489 498430
Civil Parish	Melbecks
HER ID	MYD37606
YDMP ID	-
Location	On the lower slopes of Melbecks Moor, above the intake land on the northern side of Swaledale. Northwest of the village of Gunnerside.
Geology	Alston formation lime/sand/silt/mud stone with Hardraw Scar limestone
Current land use	Rough pasture
Aspect	S facing
Approx. elevation	c.340m aOD.
Description	Described as extending along the valley side between Gunnerside and Ivelet, partly on the moor and partly under post-medieval fields. Not visible on available aerial imagery. Could not be detected on the ground.

Crackpot	
Centred On	397430 497090
Civil Parish	Grinton
HER ID	MYD58683
YDMP ID	-
Location	Located on the spur between the Swale and the valley of Haverdale Beck.
Geology	Alston formation lime/sand/silt/mud stones
Current land use	Rough pasture
Aspect	NE facing
Approx. elevation	c. 240m aOD.
Description	Remains of lynchets and settlement are visible beneath modern fields but no evidence for coaxial boundaries was visible on aerial photographs or when viewed on the ground.

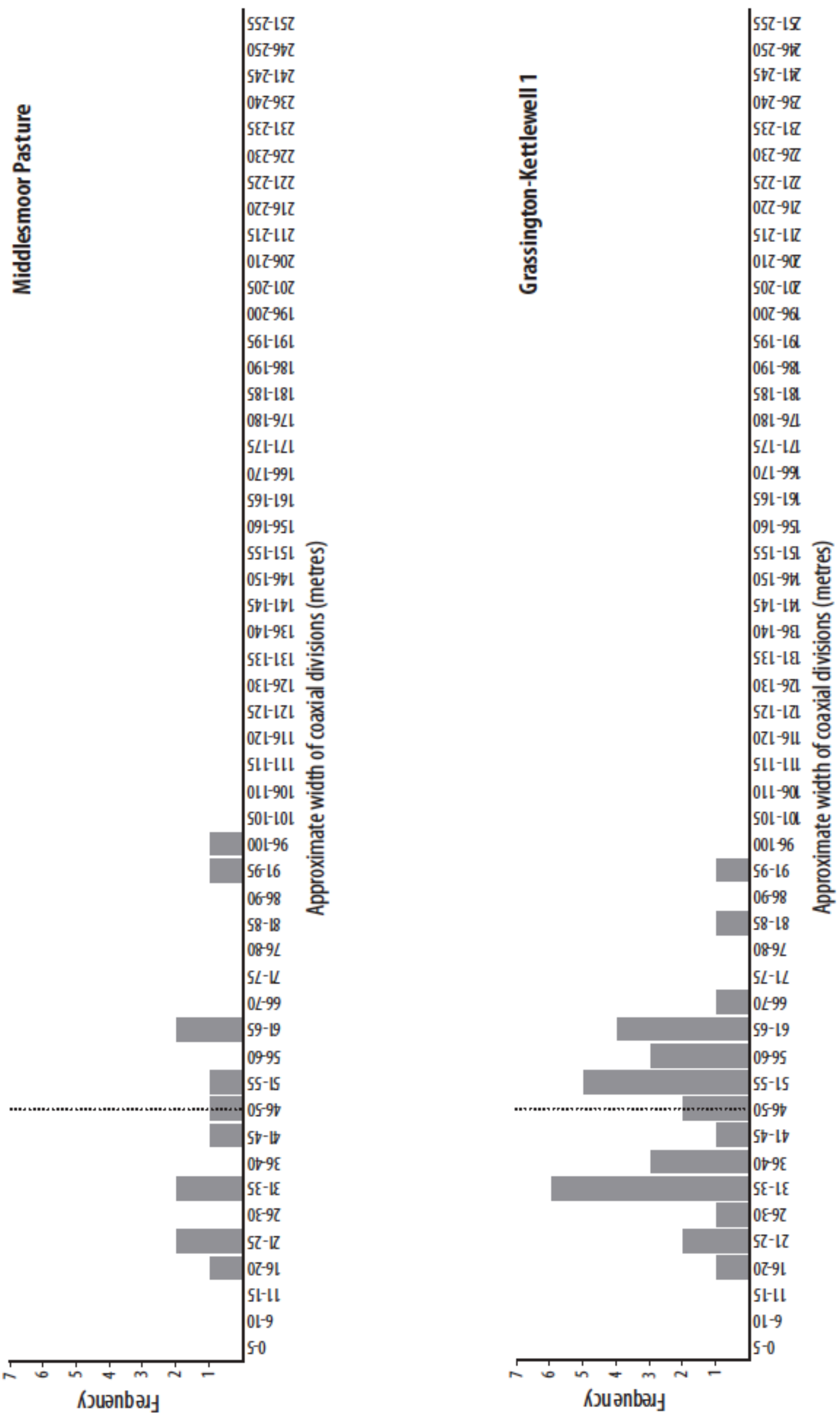
Feetham Pasture	
Centred On	398846 499255
Civil Parish	Melbecks
HER ID	MYD50802
YDMP ID	-
Location	Feetham Pasture, above the hamlet of Feetham on the north side of Swaledale.
Geology	Alston and Middle limestone with subsidiary sandstone
Current land use	Rough pasture
Aspect	SE facing
Approx. elevation	c.350m aOD
Description	Described by the HER as similar in nature to Crackpot. No evidence for coaxial boundaries was found on the available aerial imagery or on the ground. Partial heather coverage.

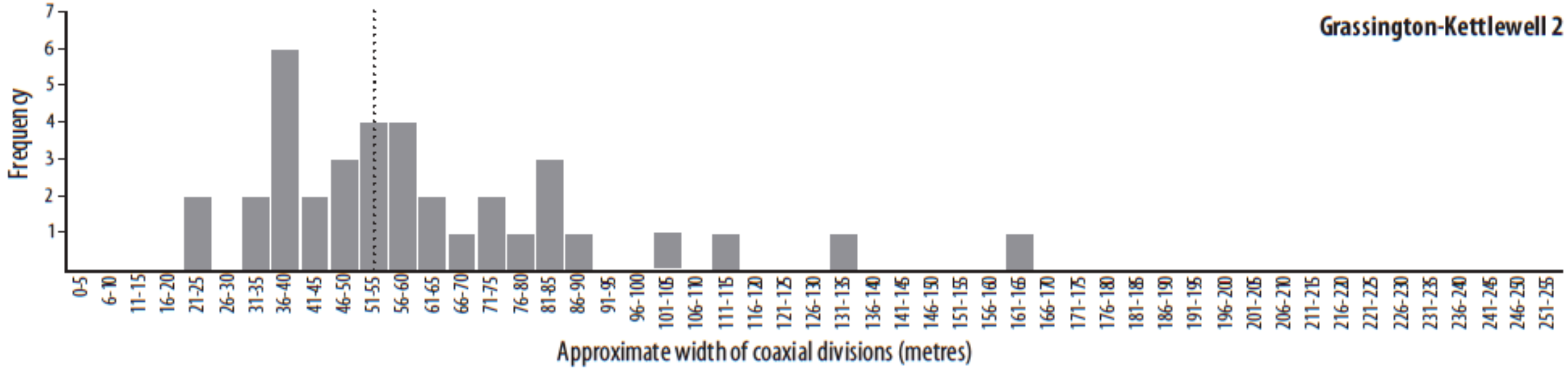
Howgills

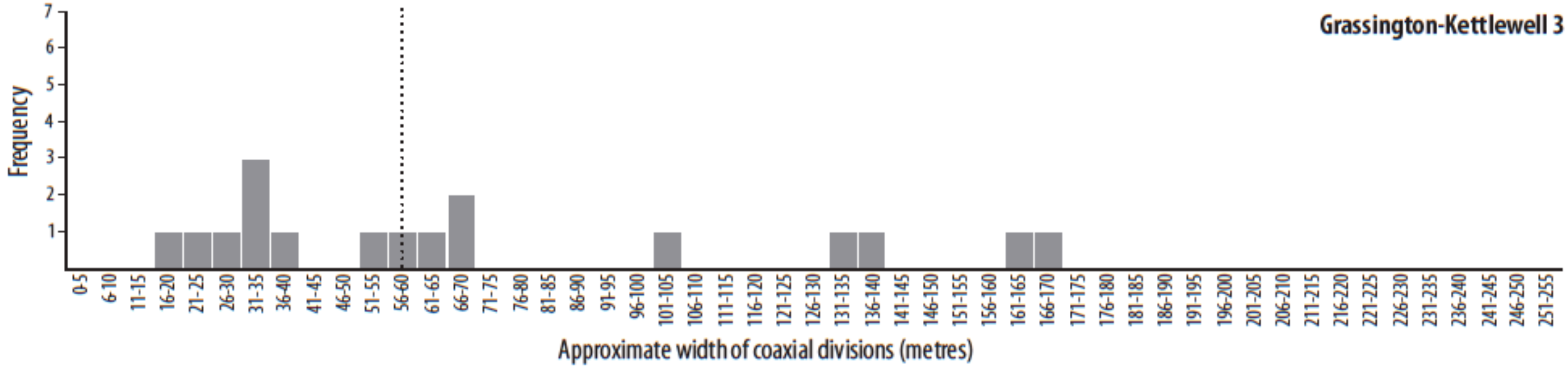
Howgill 1	
Centred On	364782 496164
Civil Parish	Sedbergh
HER ID	MYD33261
YDMP ID	-
Location	On the slopes of the Vshaped valley of Long Rigg Beck in the southwestern Howgill Fells
Geology	Bannisdale silt and mud stone
Current land use	Rough pasture
Aspect	NW facing
Approx. elevation	c.270m aOD
Description	Only 2 boundary fragments visible on available aerial imagery.

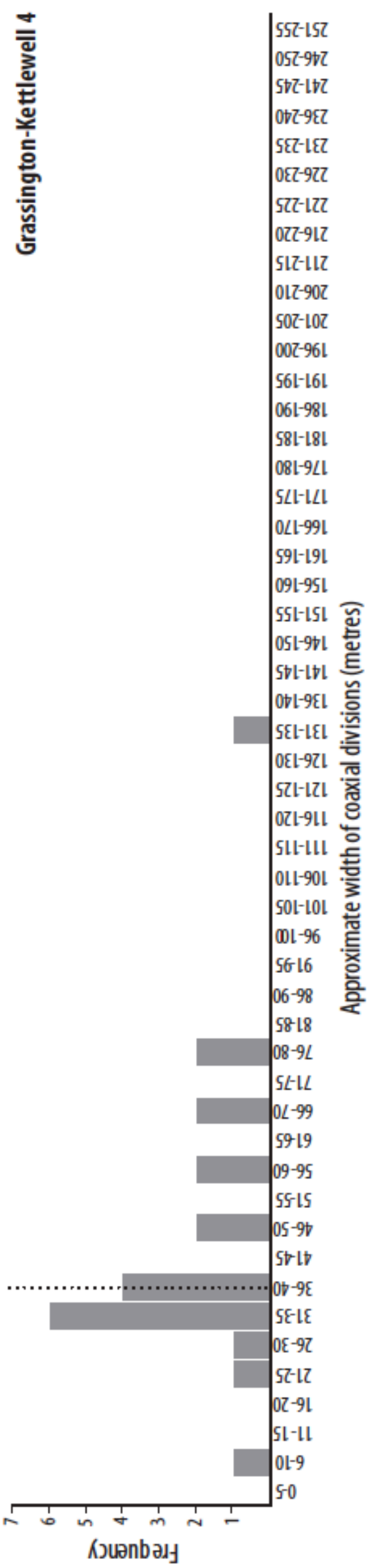
Howgills 2	
Centred On	364348 493132
Civil Parish	Sedbergh
HER ID	MYD33357
YDMP ID	-
Location	On the southwestern slope of Winder, on the southwestern edge of the Howgill Fells, immediately north of Sedbergh.
Geology	Coniston Group sand- and siltstone
Current land use	Rough pasture
Aspect	SW facing
Approx. elevation	c.250m aOD
Description	No evidence apparent on available imagery.

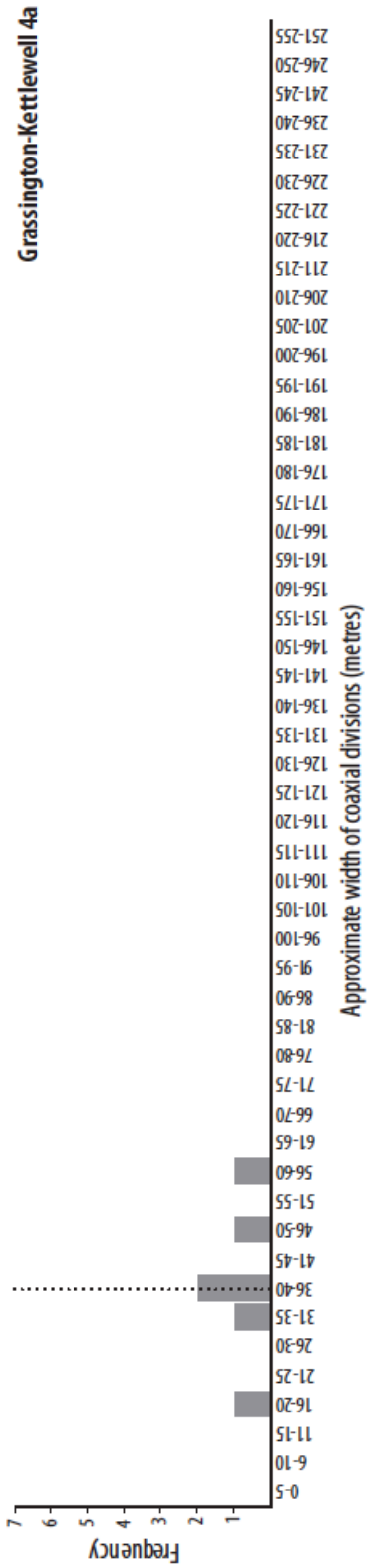
Appendix 3: Frequency with which width divisions occur in the various coaxial systems (Dotted line indicates median width)

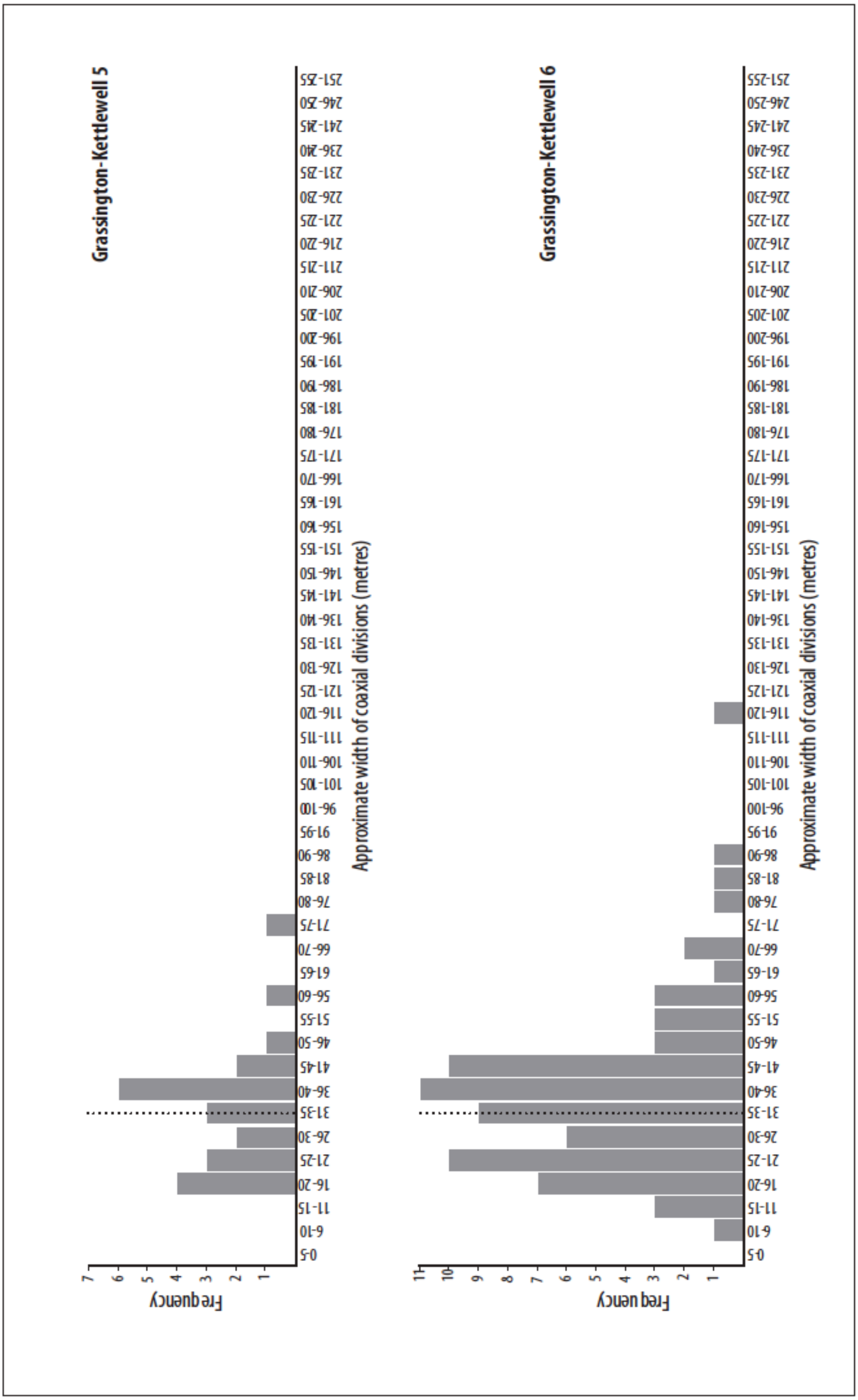


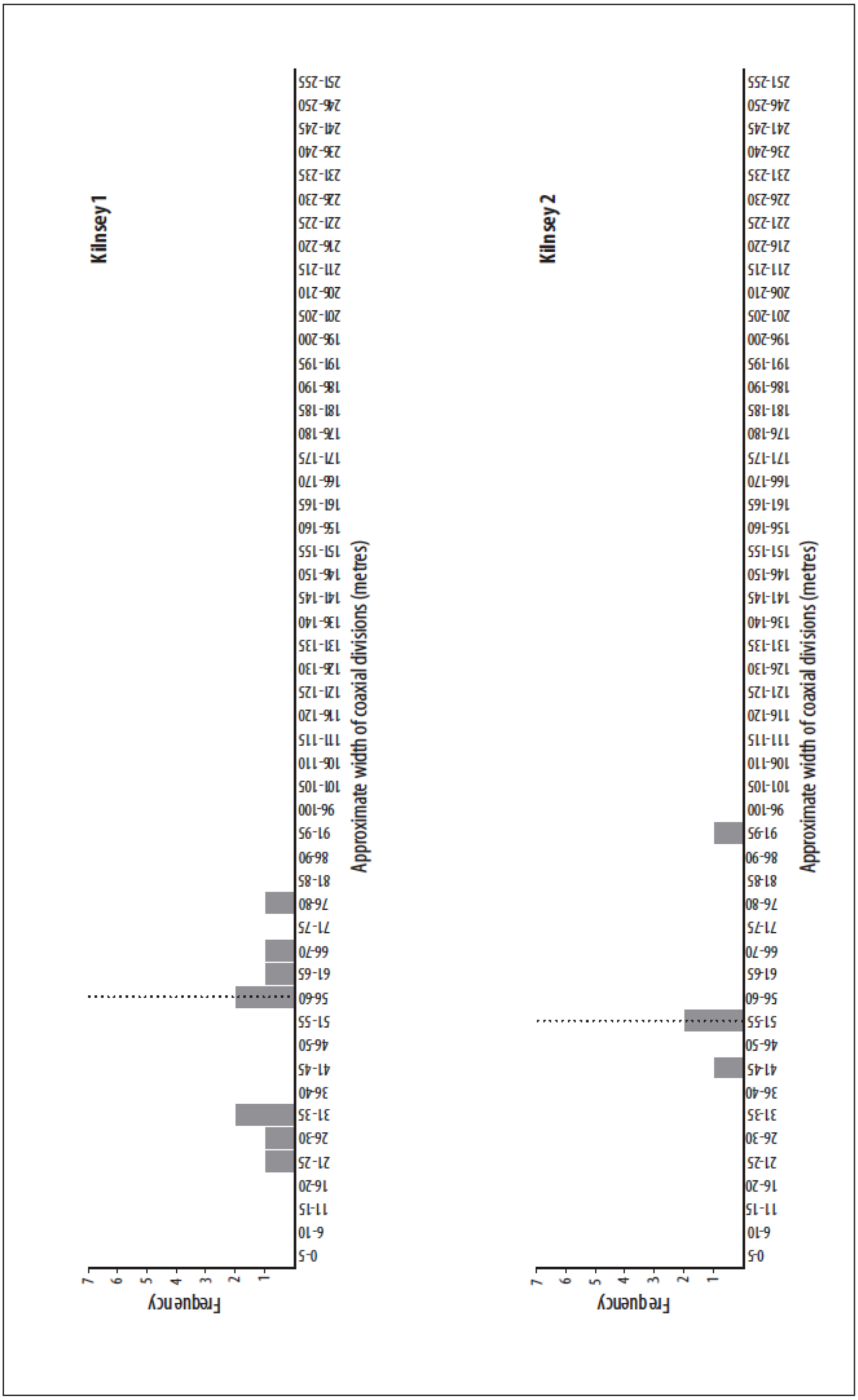

Grassington-Kettlewell 2
Frequency
1 2 3 4 5 6 7
0-5 6-10 11-15 16-20 21-25 26-30 31-35 36-40 41-45 46-50 51-55 56-60 61-65 66-70 71-75 76-80 81-85 86-90 91-95 96-100 101-105 106-110 111-115 116-120 121-125 126-130 131-135 136-140 141-145 146-150 151-155 156-160 161-165 166-170 171-175 176-180 181-185 186-190 191-195 196-200 201-205 206-210 211-215 216-220 221-225 226-230 231-235 236-240 241-245 246-250 251-255
Approximate width of coaxial divisions (metres)

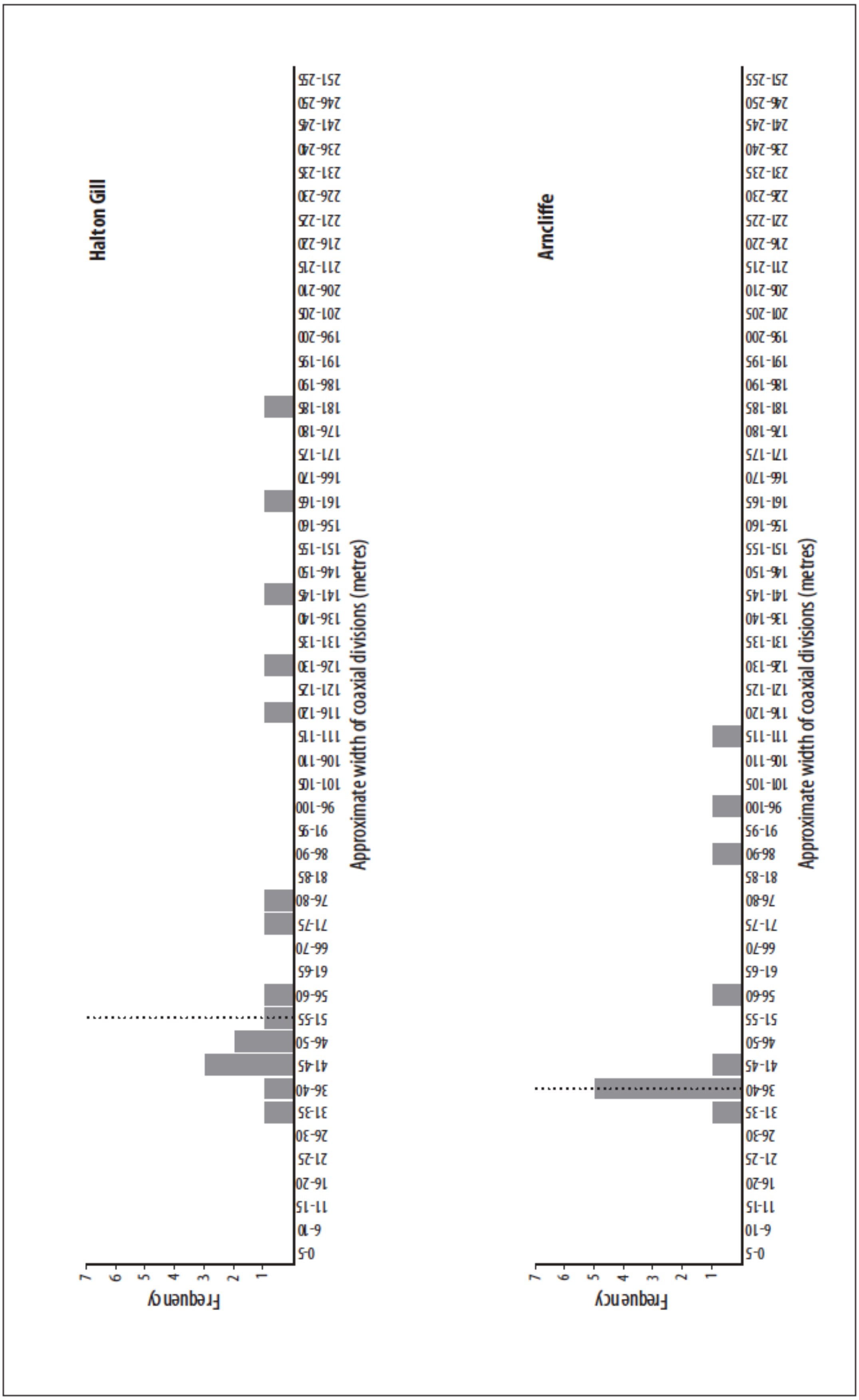

Grassington-Kettlewell 3
Frequency
1 2 3 4 5 6 7
0-5 6-10 11-15 16-20 21-25 26-30 31-35 36-40 41-45 46-50 51-55 56-60 61-65 66-70 71-75 76-80 81-85 86-90 91-95 96-100 101-105 106-110 111-115 116-120 121-125 126-130 131-135 136-140 141-145 146-150 151-155 156-160 161-165 166-170 171-175 176-180 181-185 186-190 191-195 196-200 201-205 206-210 211-215 216-220 221-225 226-230 231-235 236-240 241-245 246-250 251-255
Approximate width of coaxial divisions (metres)


Grassington-Kettlewell 4
Frequency
Approximate width of coaxial divisions (metres)

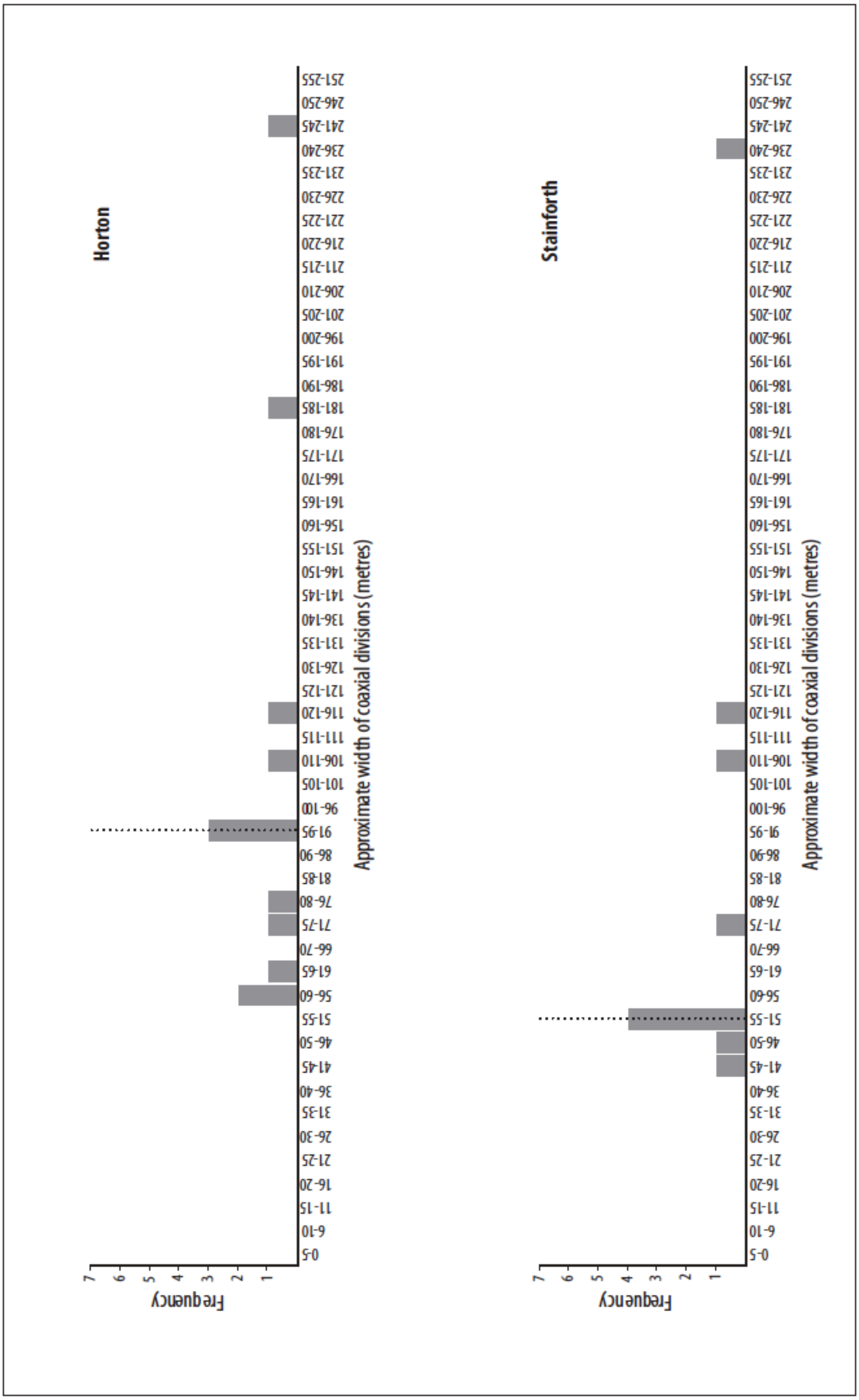

Grassington-Kettlewell 4a
Frequency
Approximate width of coaxial divisions (metres)

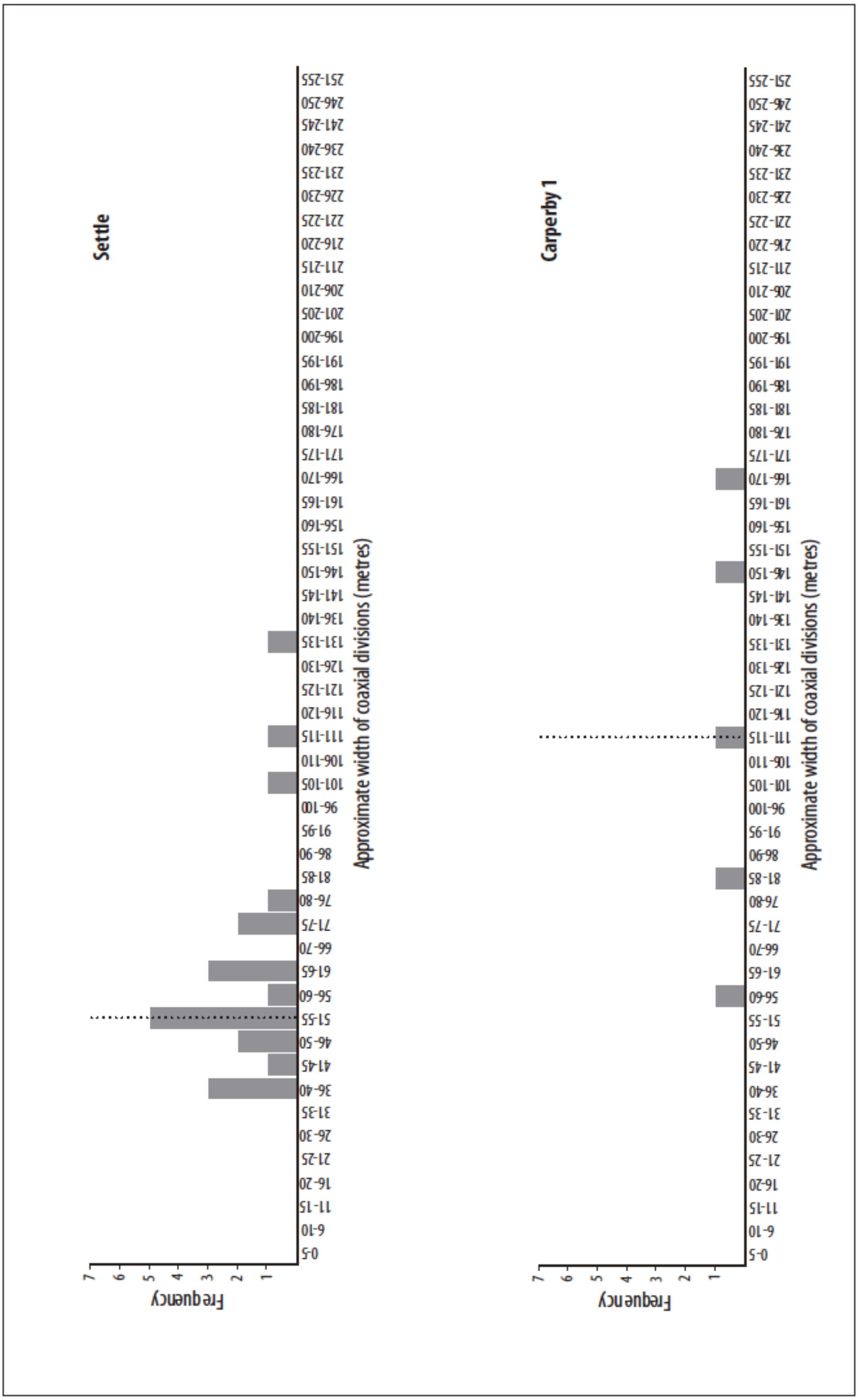

Grassington-Kettlewell 5
Approximate width of coaxial divisions (metres)
Frequency
Grassington-Kettlewell 6
Approximate width of coaxial divisions (metres)
Frequency

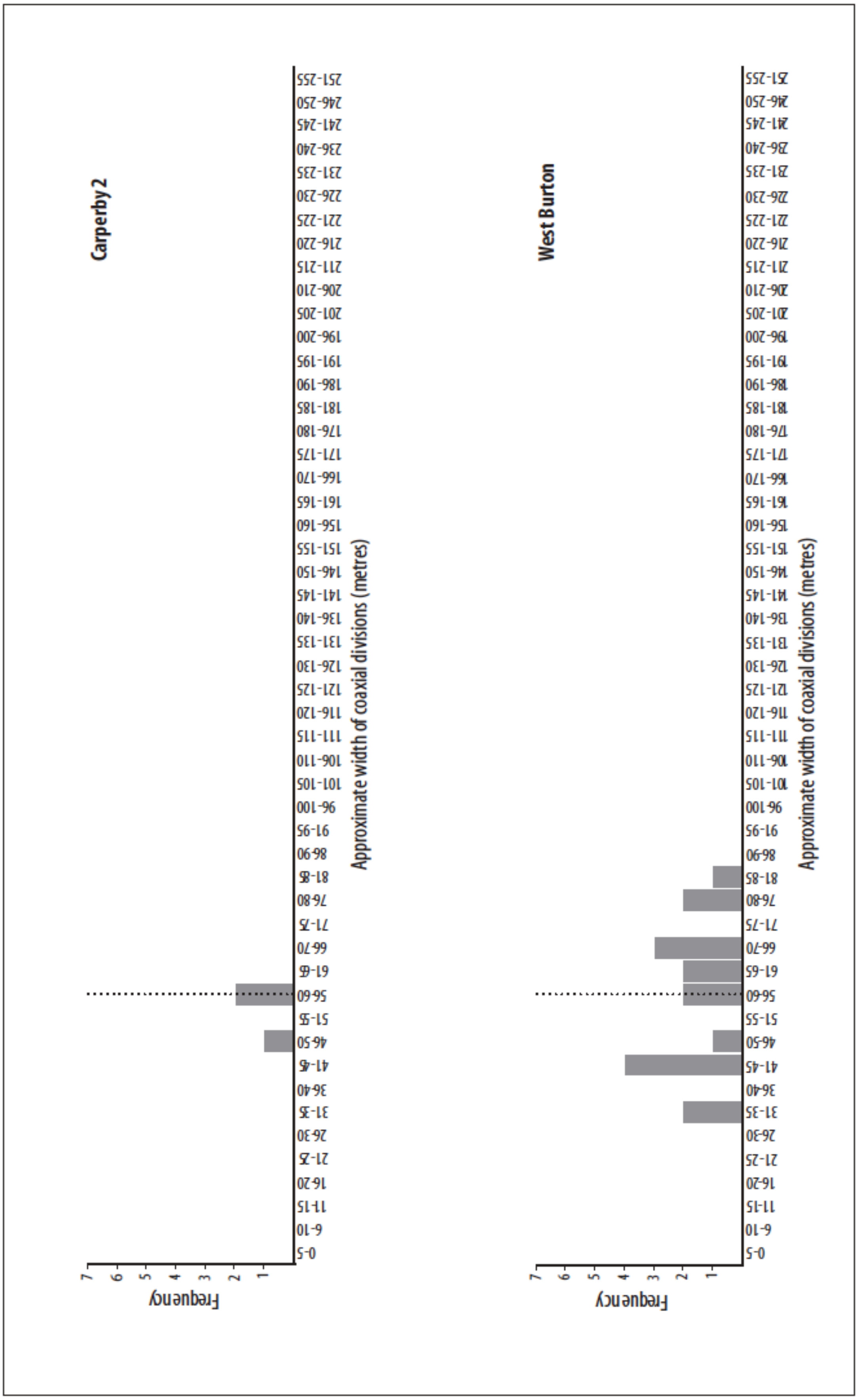

Kilnsey 1
Kilnsey 2
Approximate width of coaxial divisions (metres)
Frequency

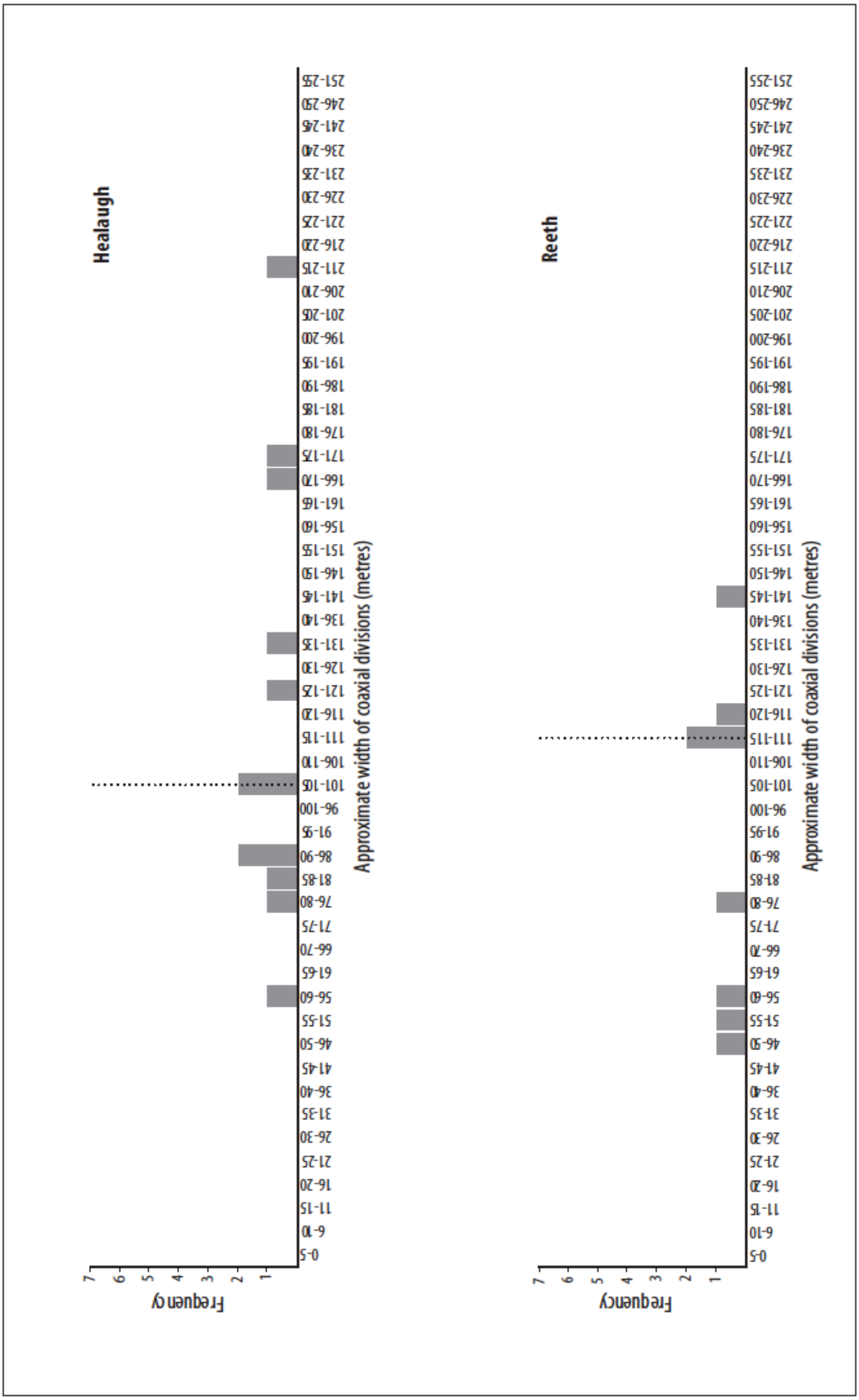


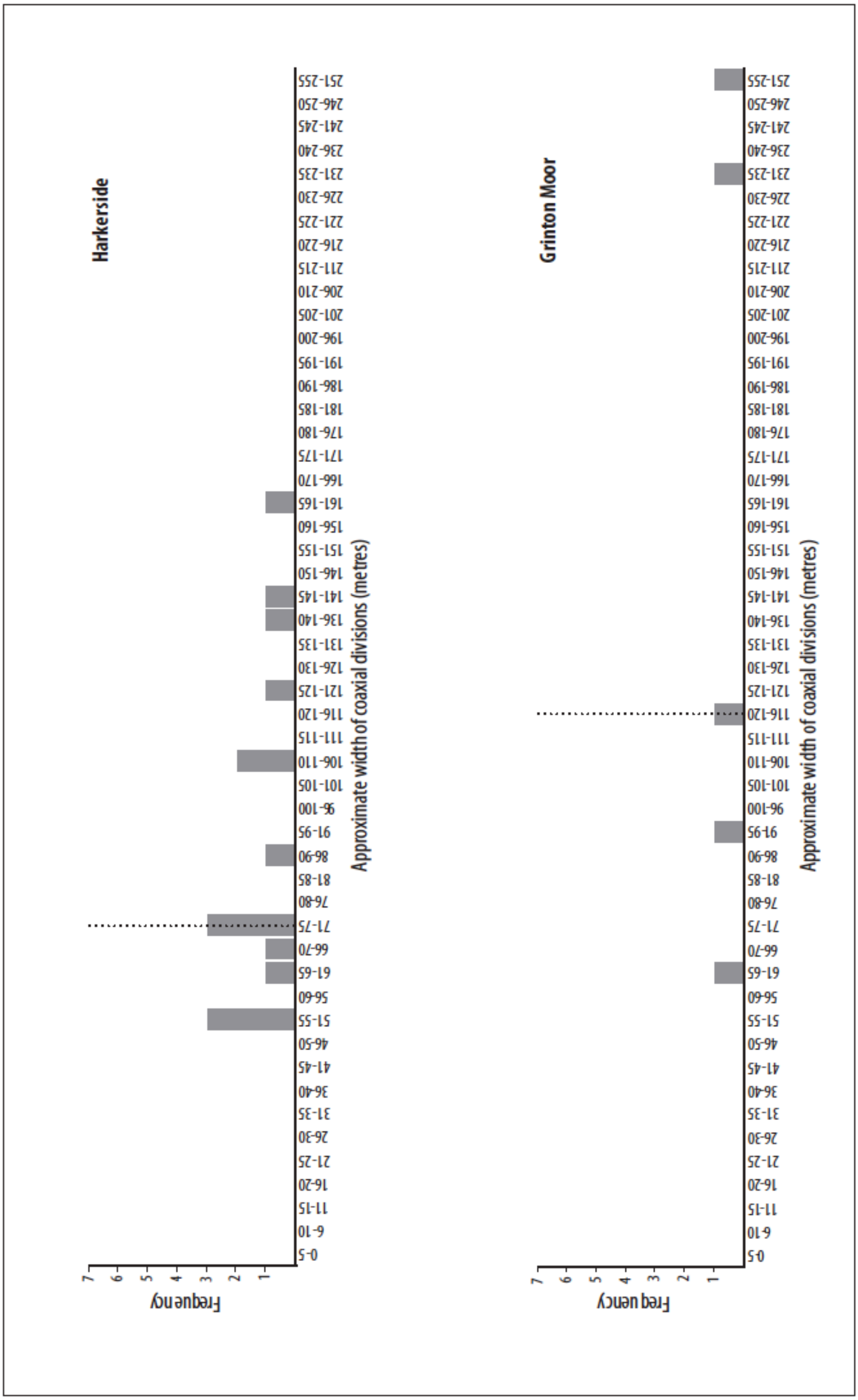
Halton Gill
Arncliffe
Approximate width of coaxial divisions (metres)
Frequency


Horton
Stainforth
Approximate width of coaxial divisions (metres)
Frequency


Settle
Frequency
Approximate width of coaxial divisions (metres)
Carperby 1
Frequency
Approximate width of coaxial divisions (metres)

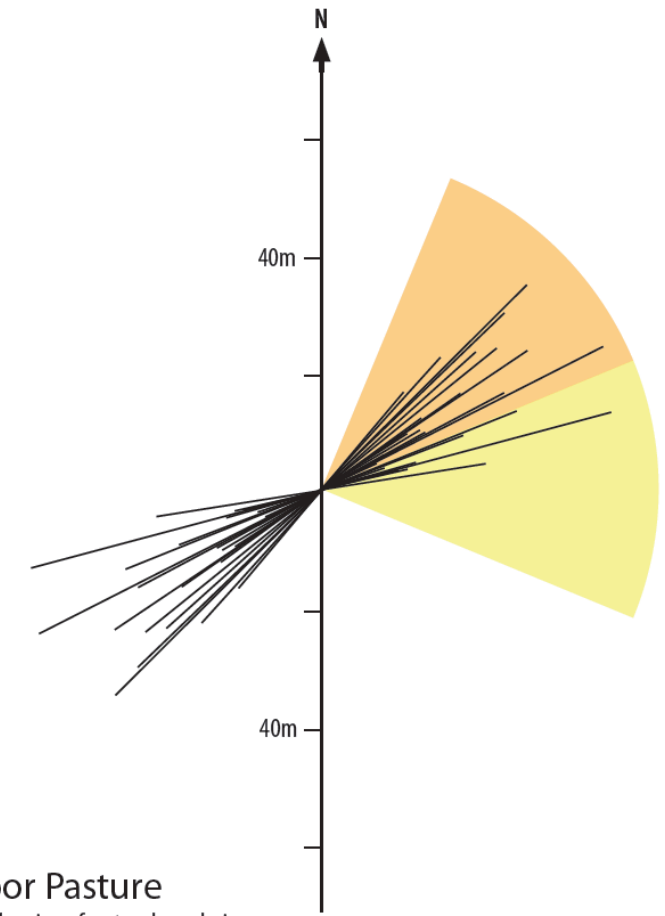

Carperby 2
West Burton
Frequency
Approximate width of coaxial divisions (metres)


Healaugh
Reeth
Approximate width of coaxial divisions (metres)
Frequency

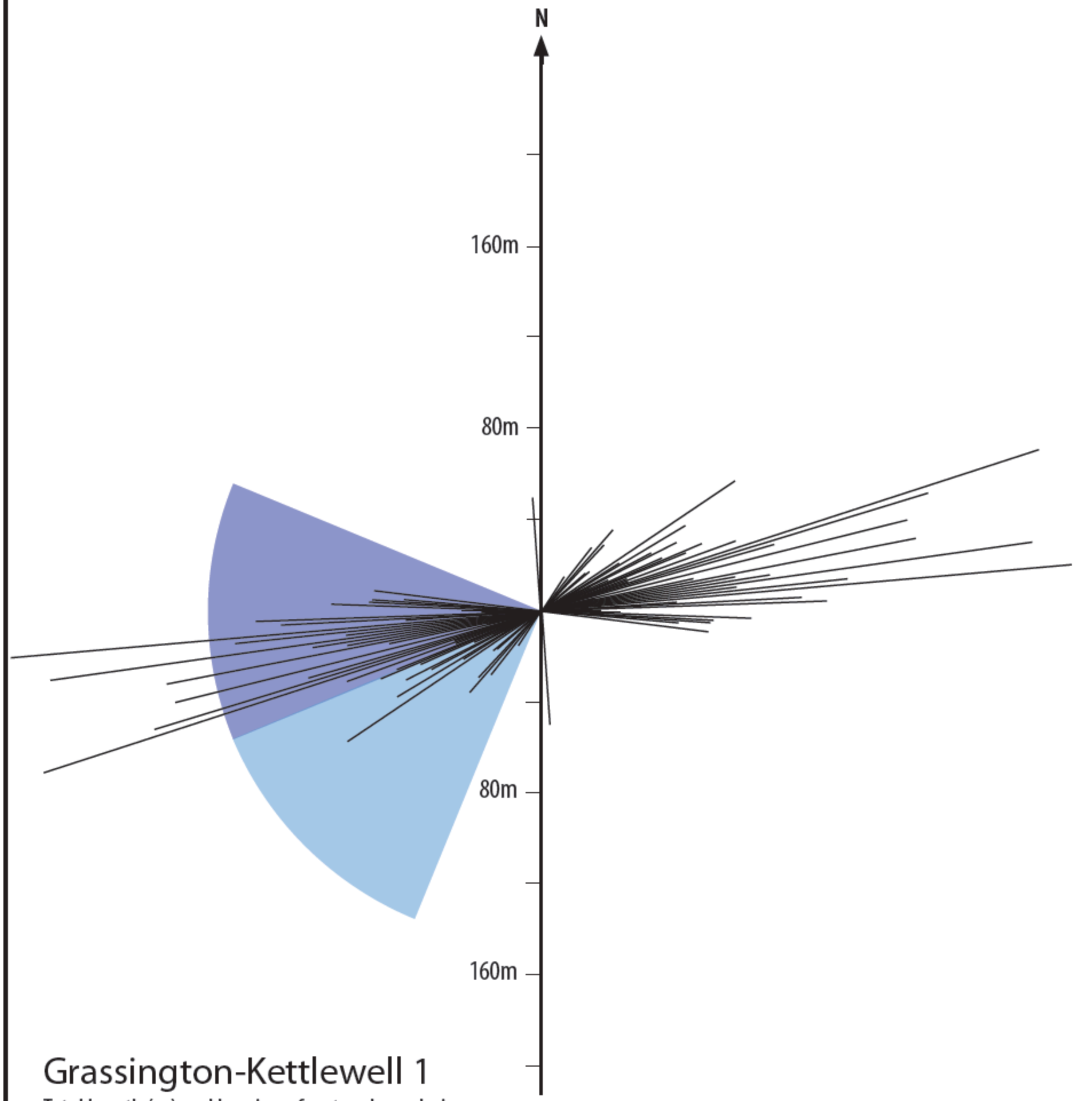

Harkerside
Grinton Moor
Frequency
Approximate width of coaxial divisions (metres)

Appendix 4: Boundary orientation and hillside aspect diagrams

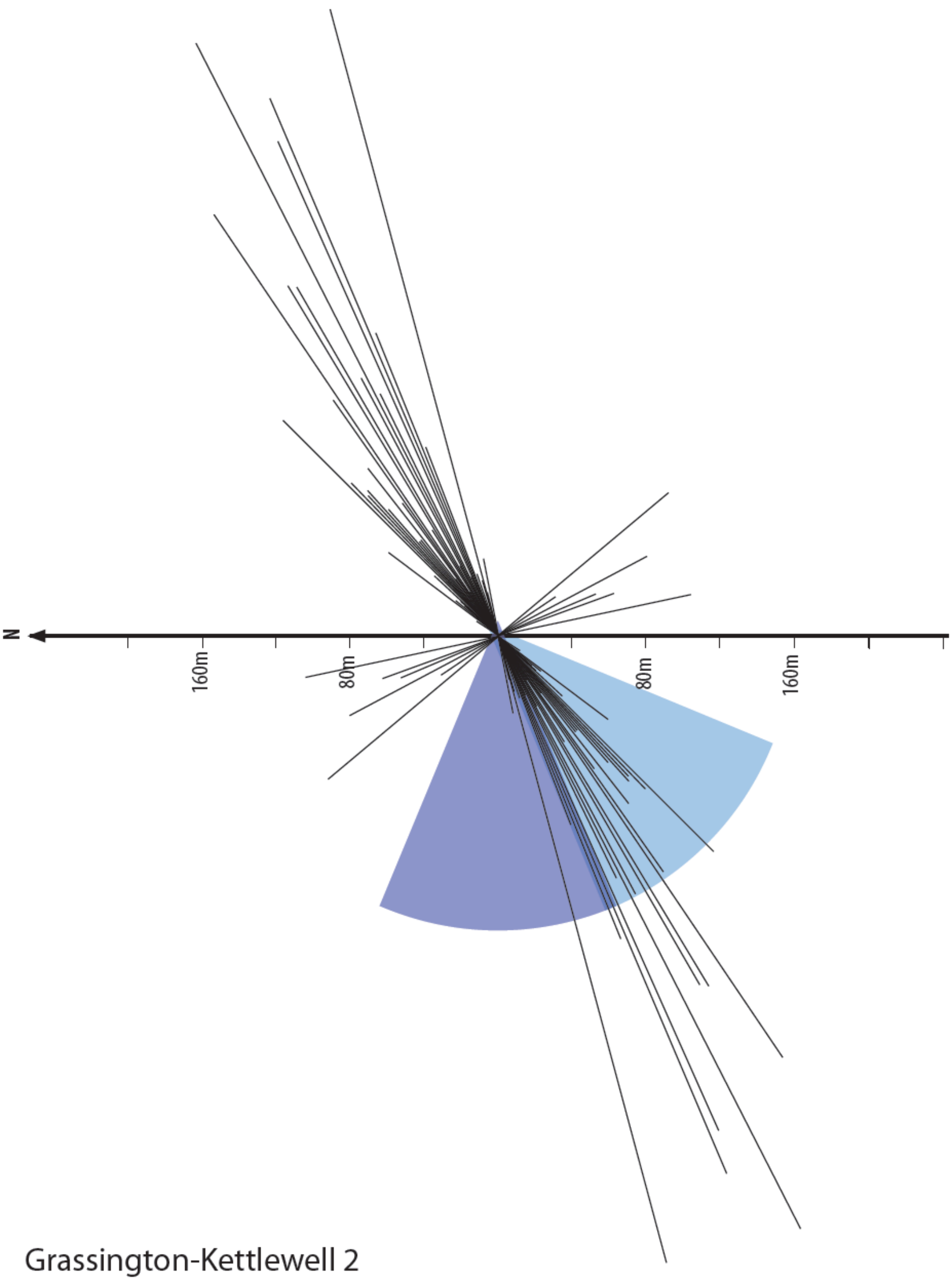
Rays represent the orientation and length of boundaries in each system; both possible directions are presented as boundaries do not actively demonstrate preference for upslope or downslope *i.e.* NW *and* SW are illustrated for a boundary aligned NW-SE. The coloured sectors represent the primary and secondary aspects of the hillside; colours correspond to fig. 5.28.



Middlesmoor Pasture
Total length (m) and bearing of system boundaries

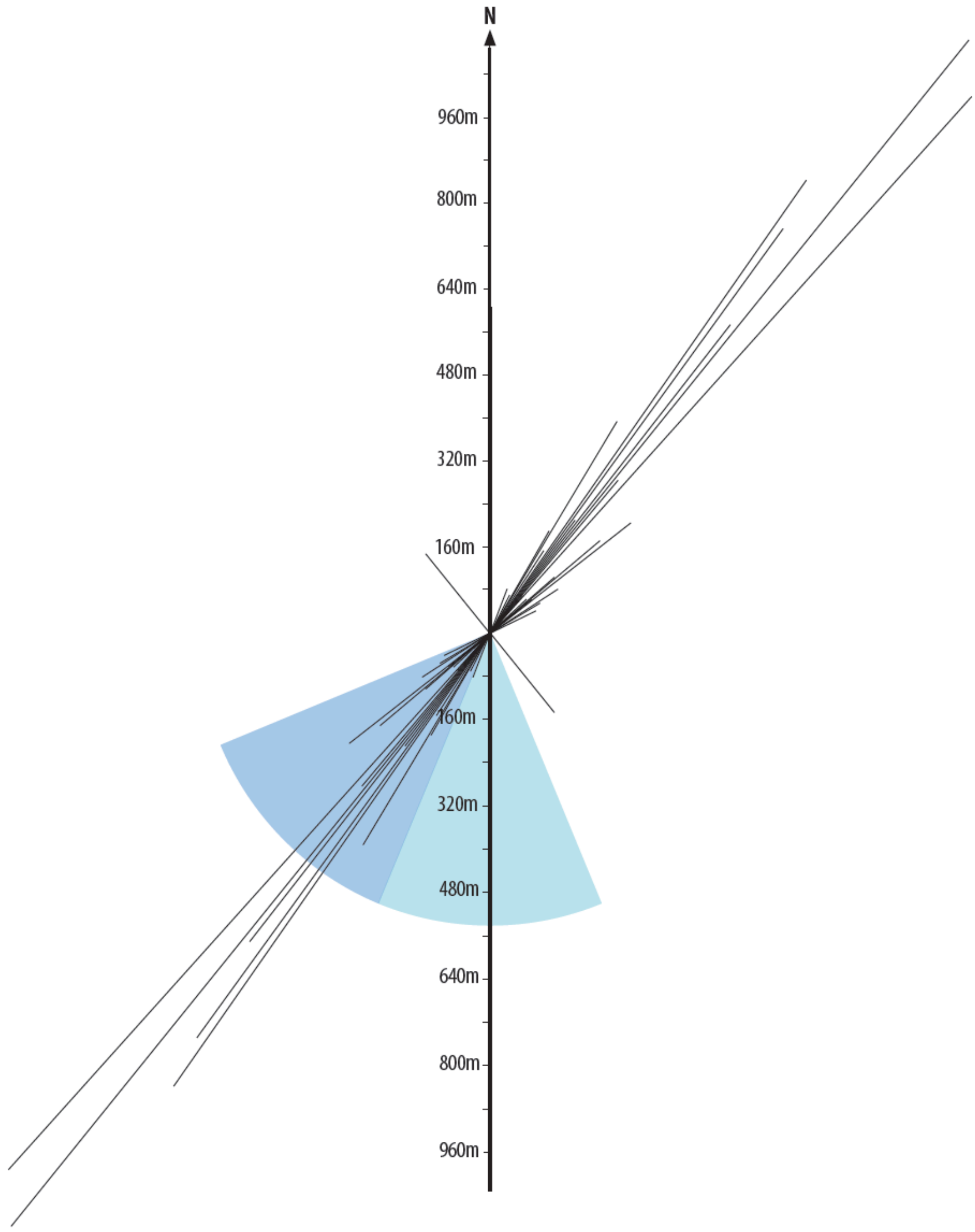


Grassington-Kettlewell 1
Total length (m) and bearing of system boundaries

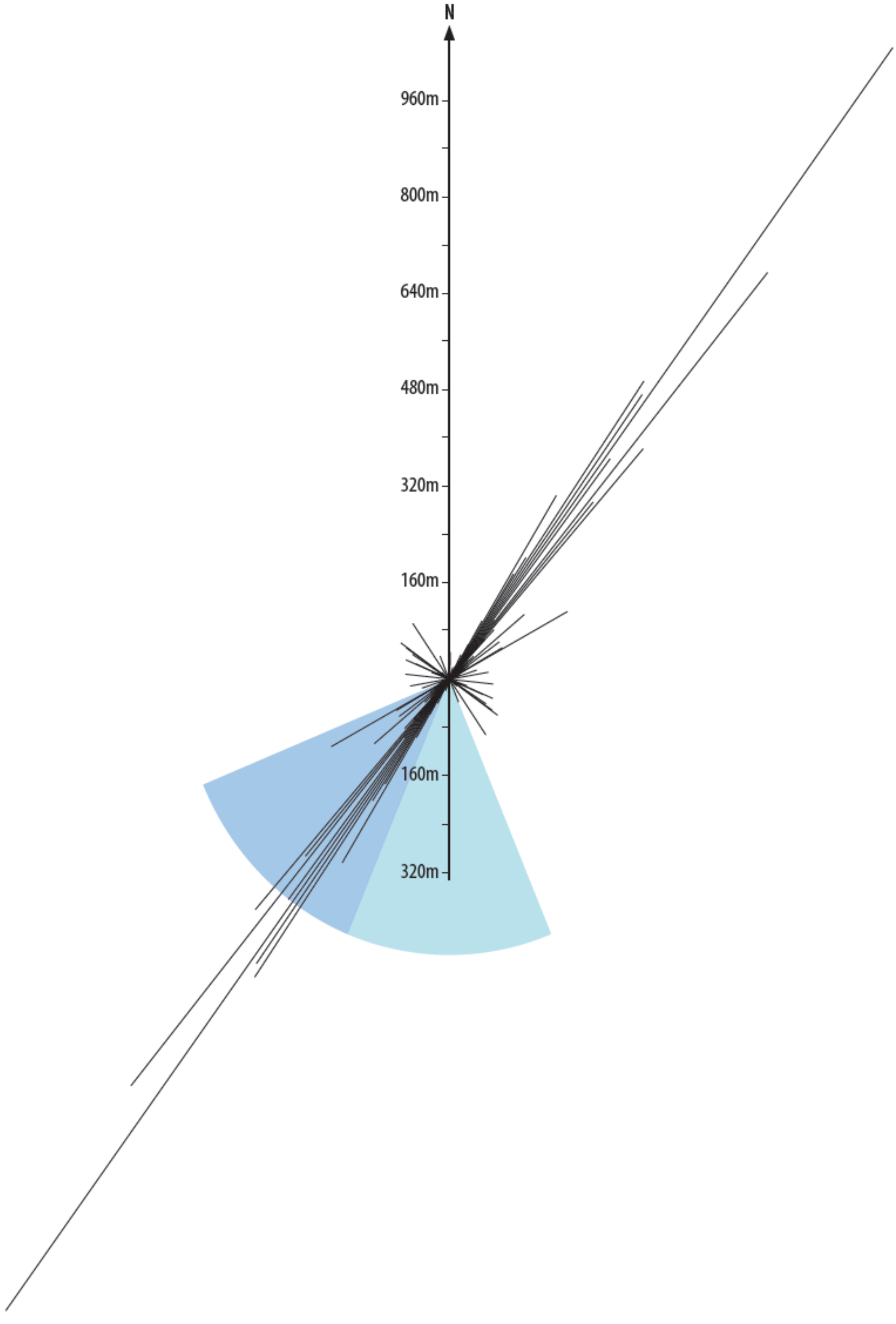


Grassington-Kettlewell 2

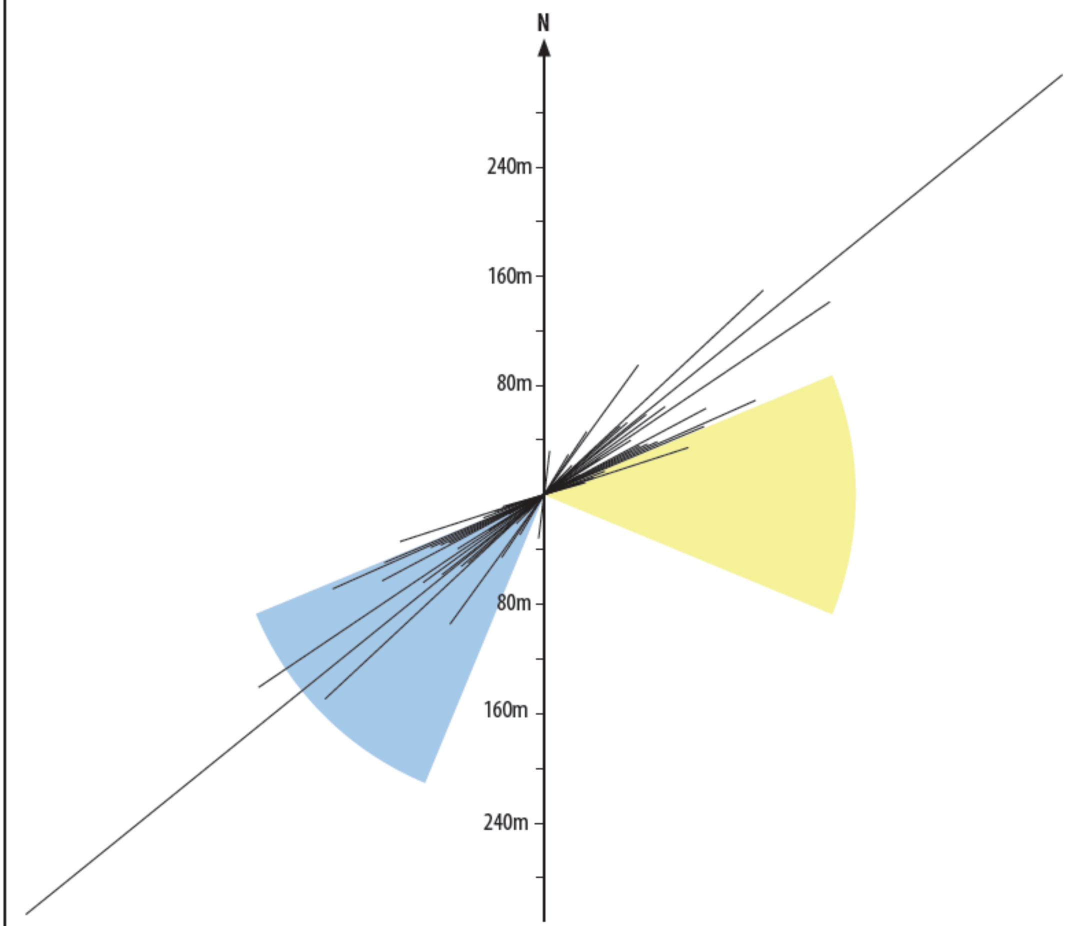
Total length (m) and bearing of system boundaries



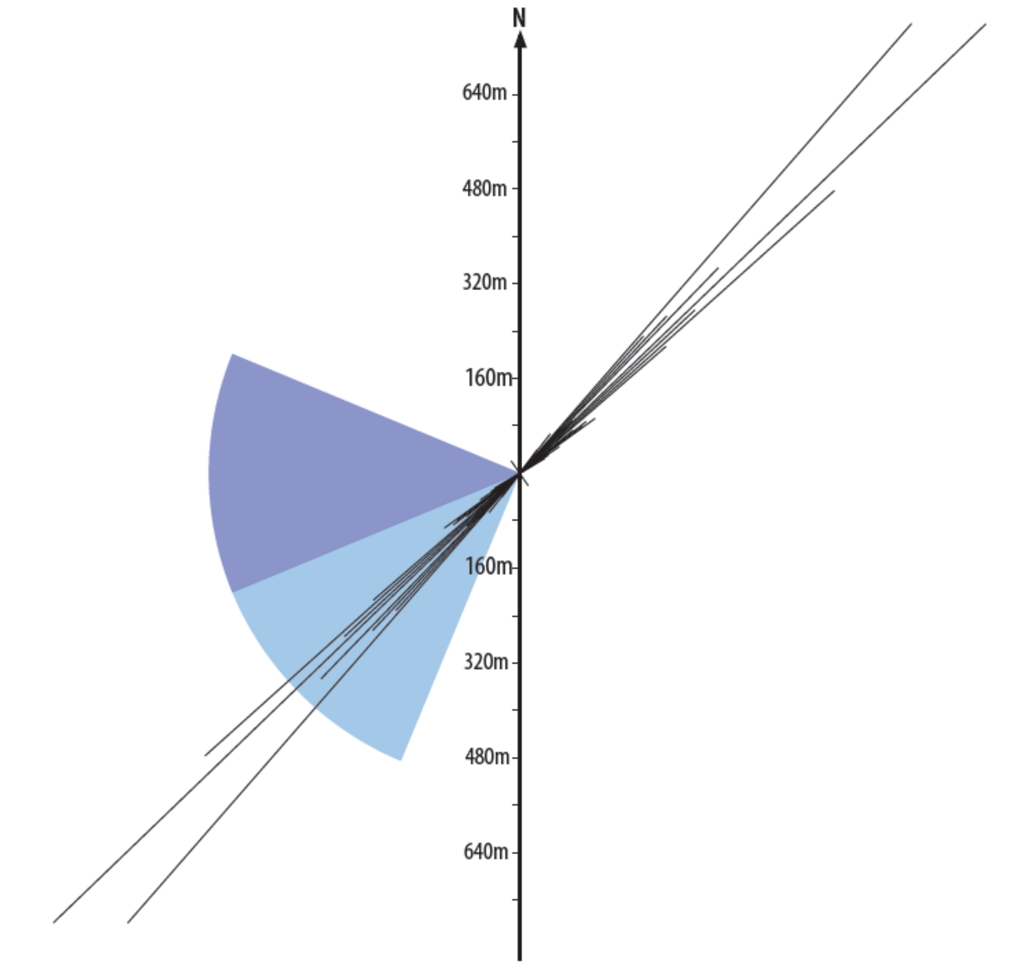
Grassington-Kettlewell 3
Total length (m) and bearing of system boundaries



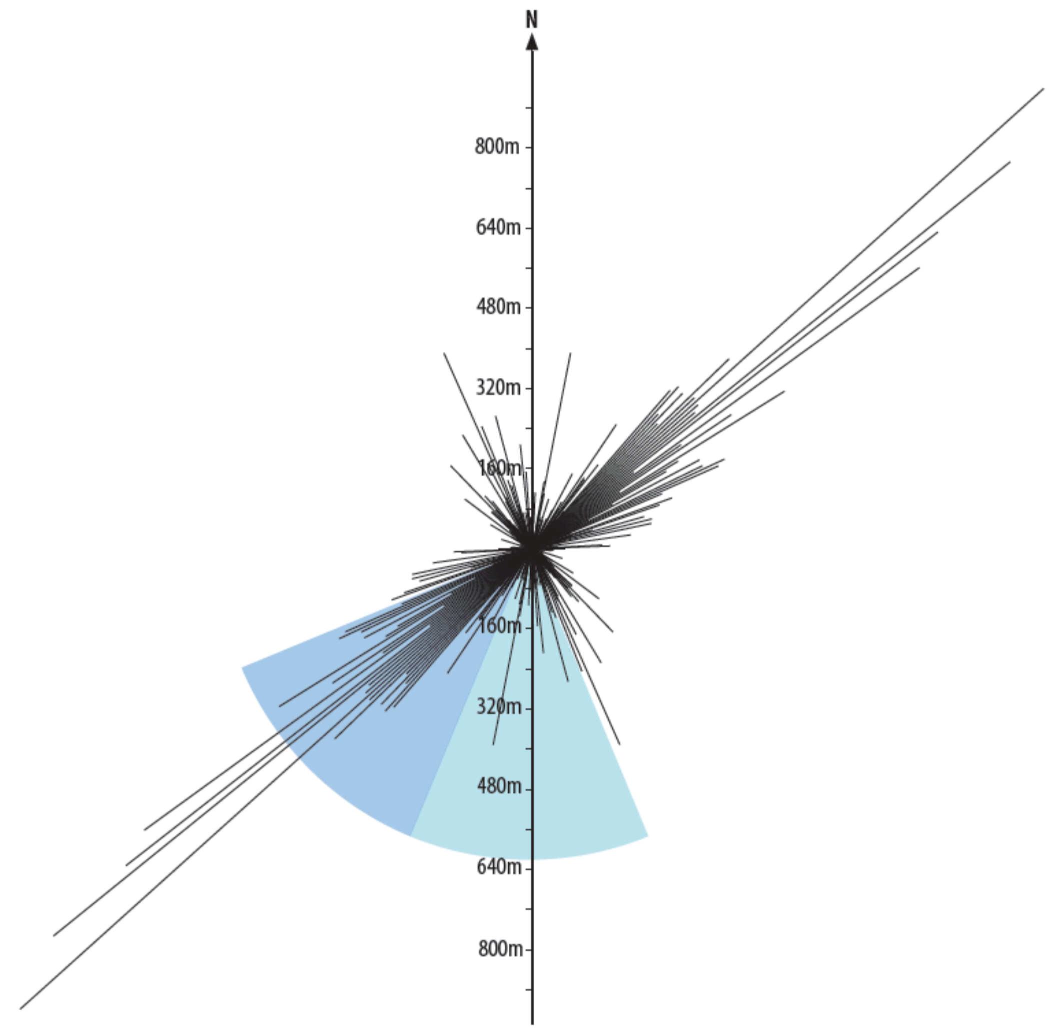
Grassington-Kettlewell 4
Total length (m) and bearing of system boundaries



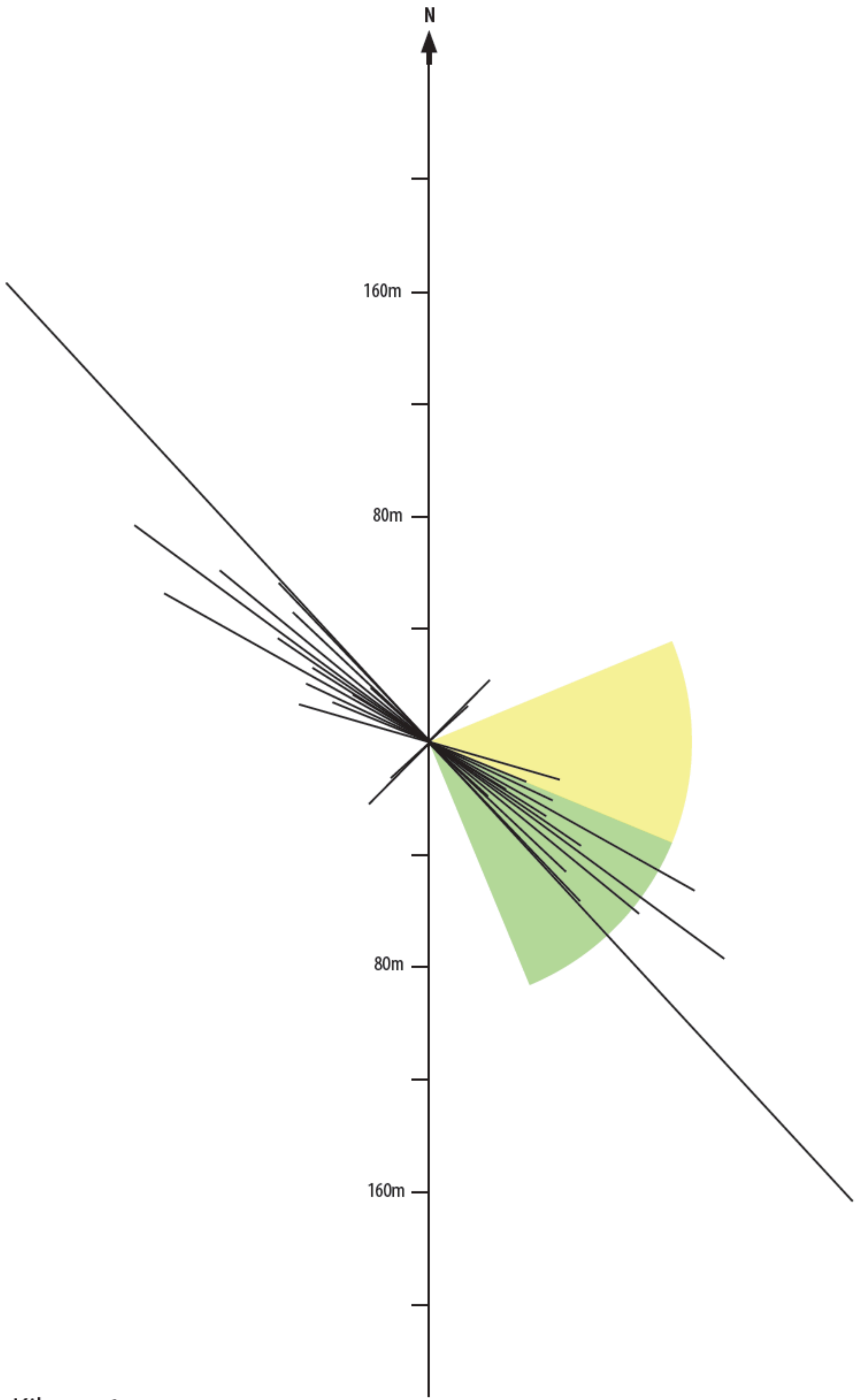
Grassington-Kettlewell 4a
Total length (m) and bearing of system boundaries



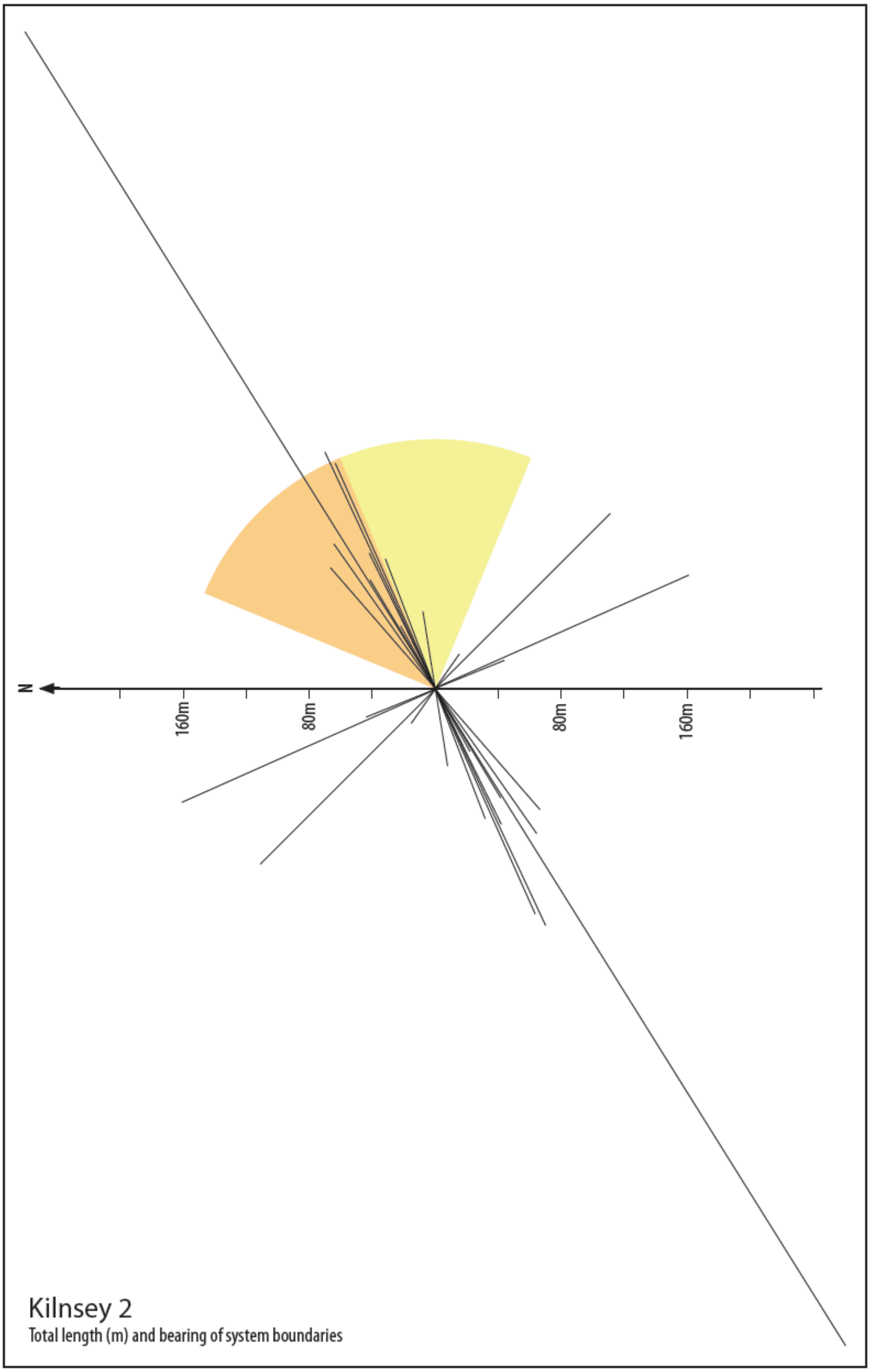
Grassington-Kettlewell 5
Total length (m) and bearing of system boundaries



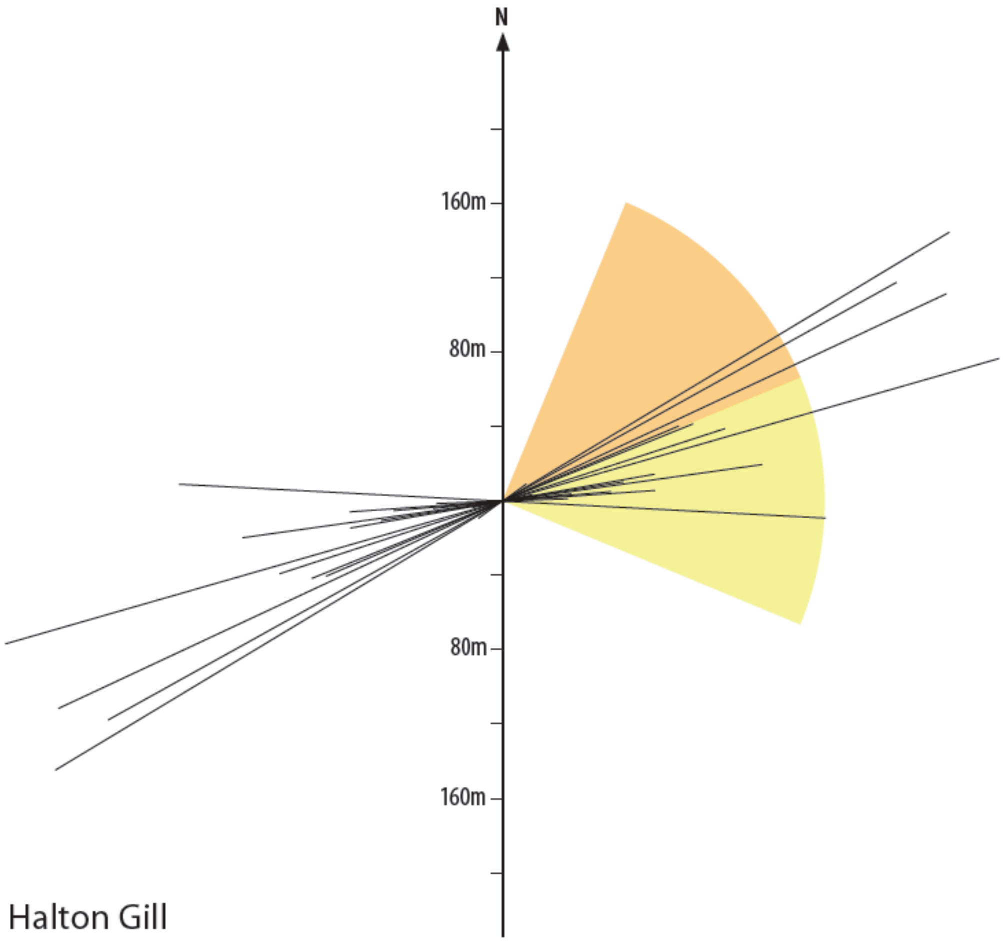
Grassington-Kettlewell 6
Total length (m) and bearing of system boundaries



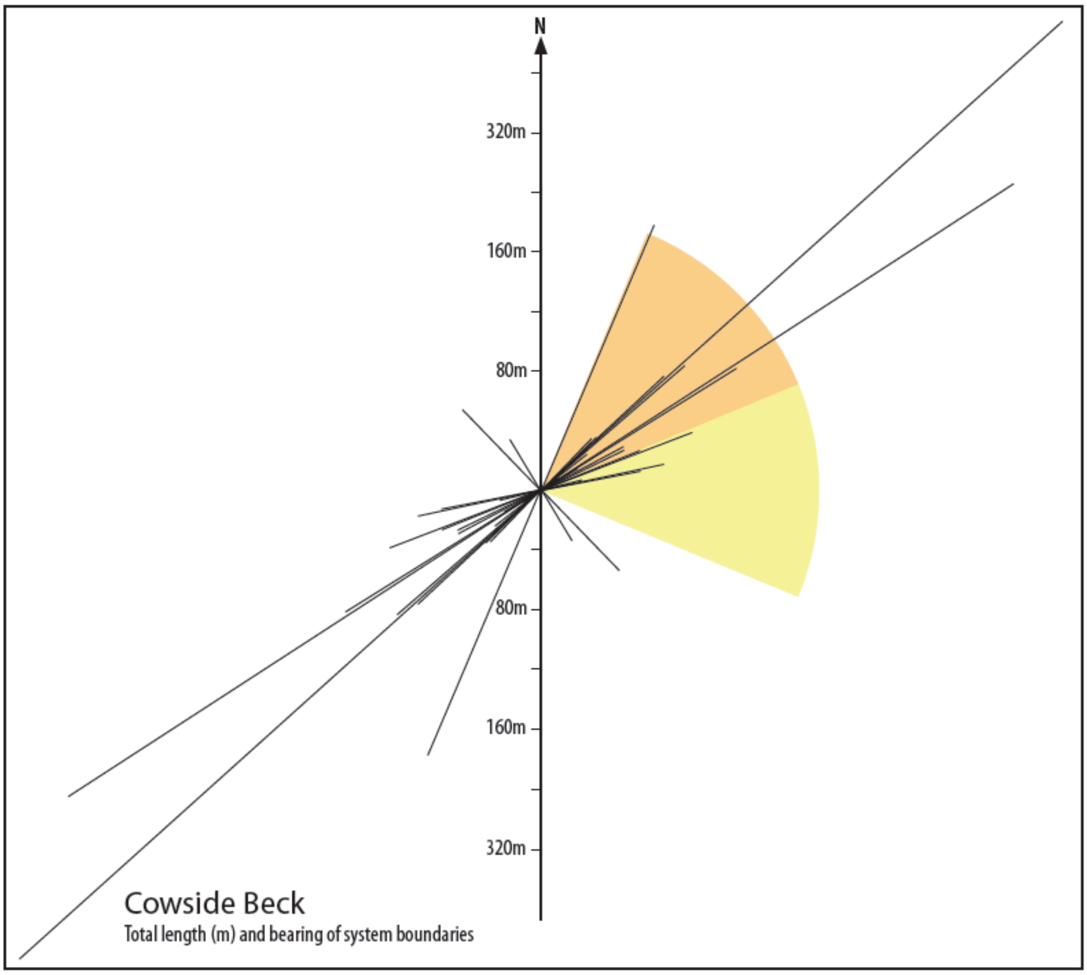
Kilnsey 1
Total length (m) and bearing of system boundaries

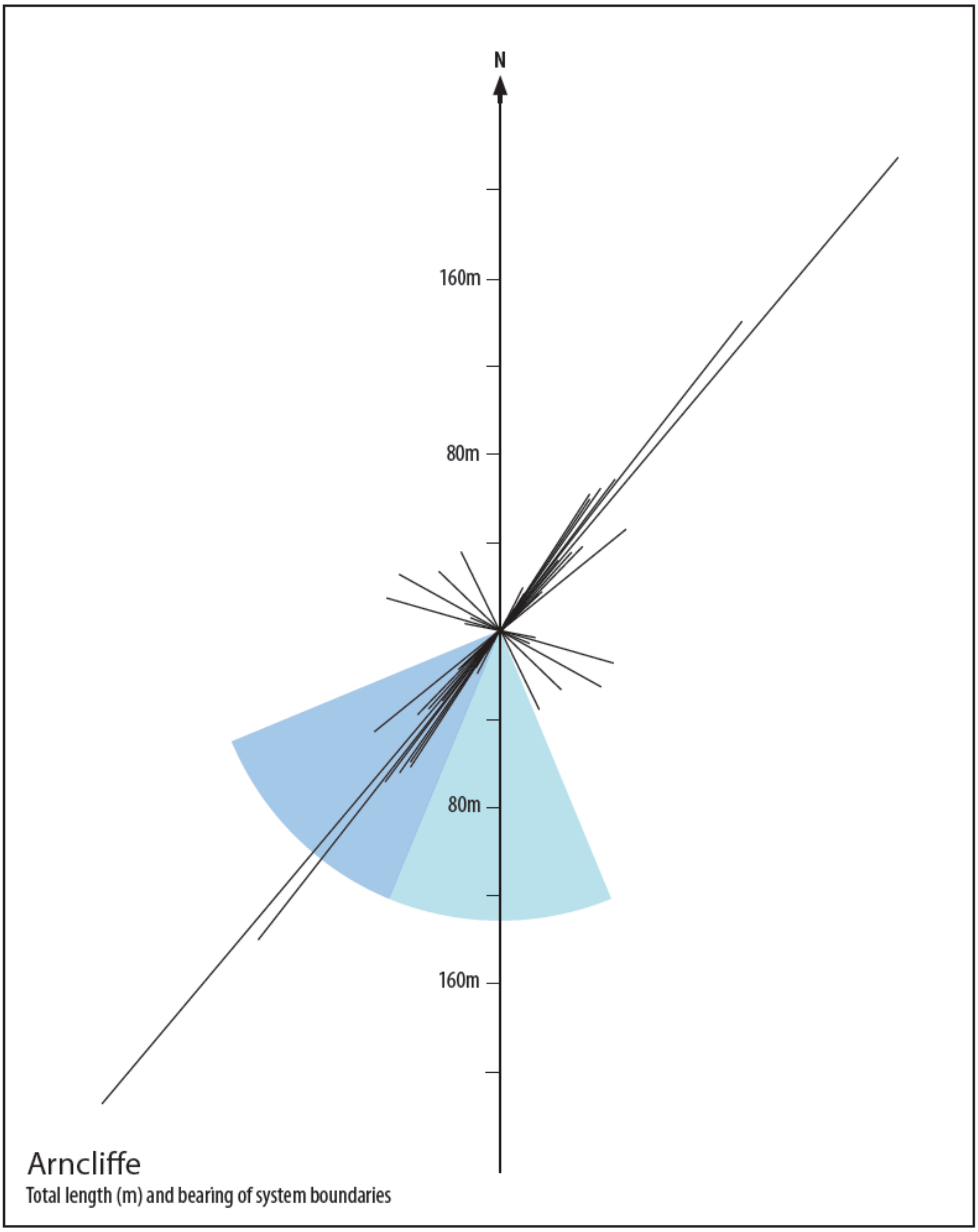


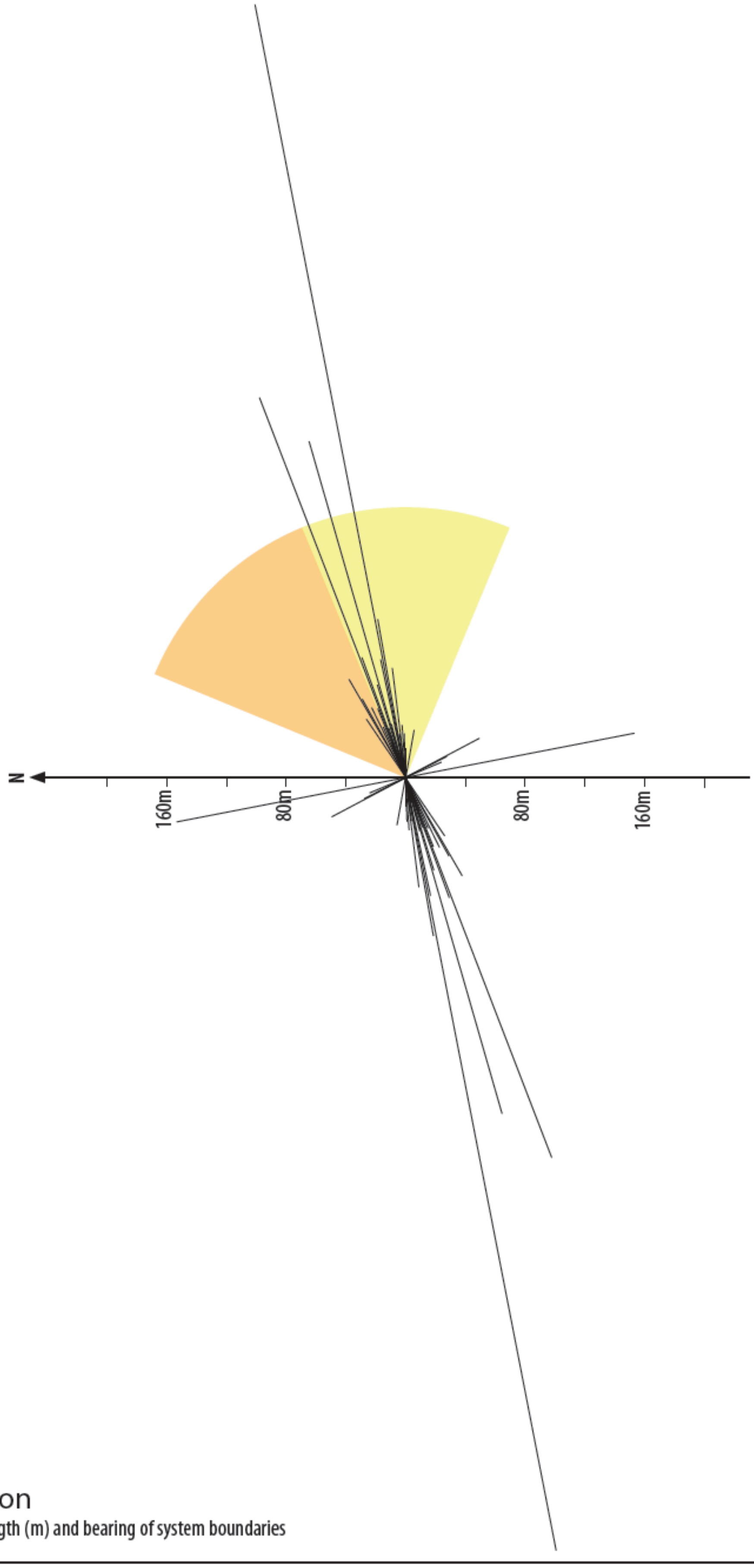
Kilnsey 2
Total length (m) and bearing of system boundaries



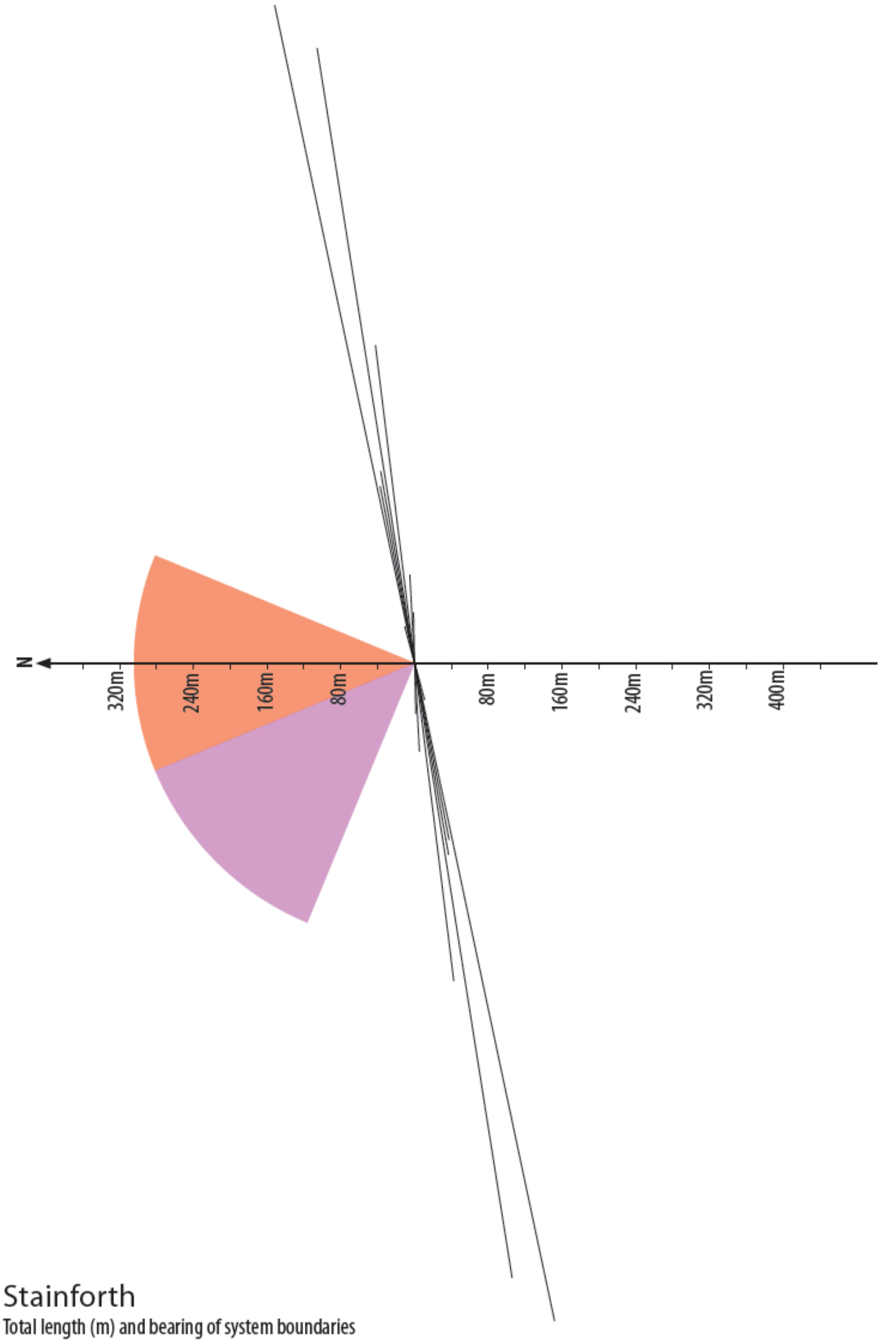
Halton Gill
Total length (m) and bearing of system boundaries


N
320m
160m
80m
80m
160m
320m
Cowside Beck
Total length (m) and bearing of system boundaries

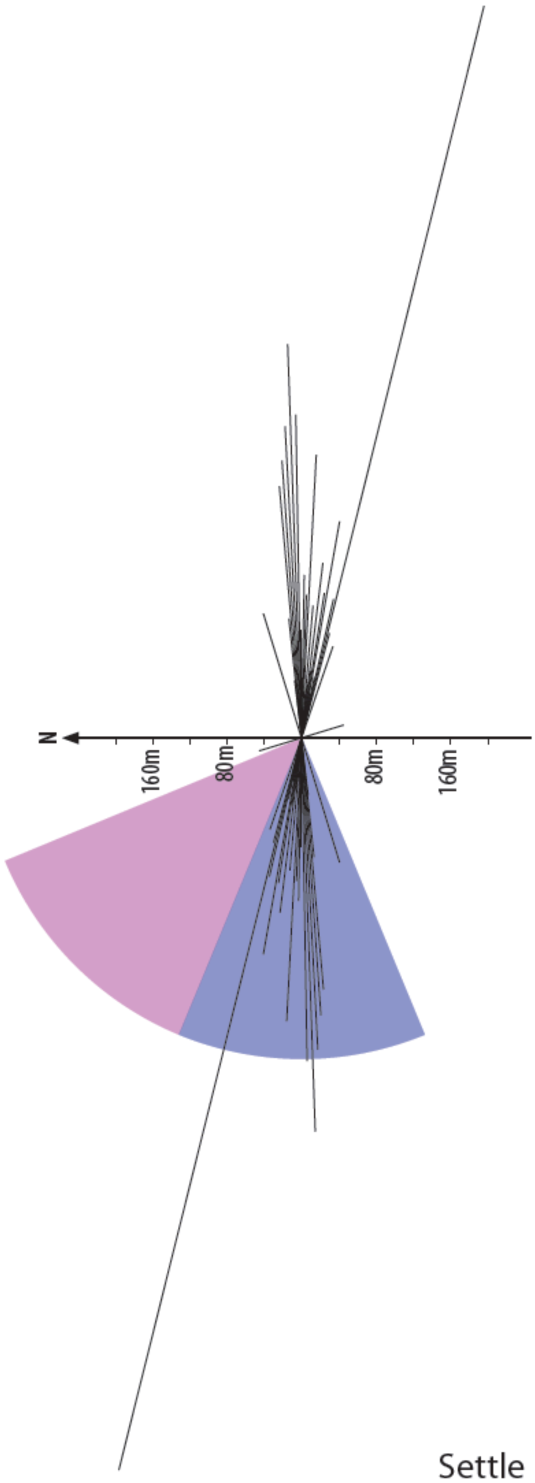

N
160m
80m
80m
160m
Arncliffe
Total length (m) and bearing of system boundaries



Horton
Total length (m) and bearing of system boundaries

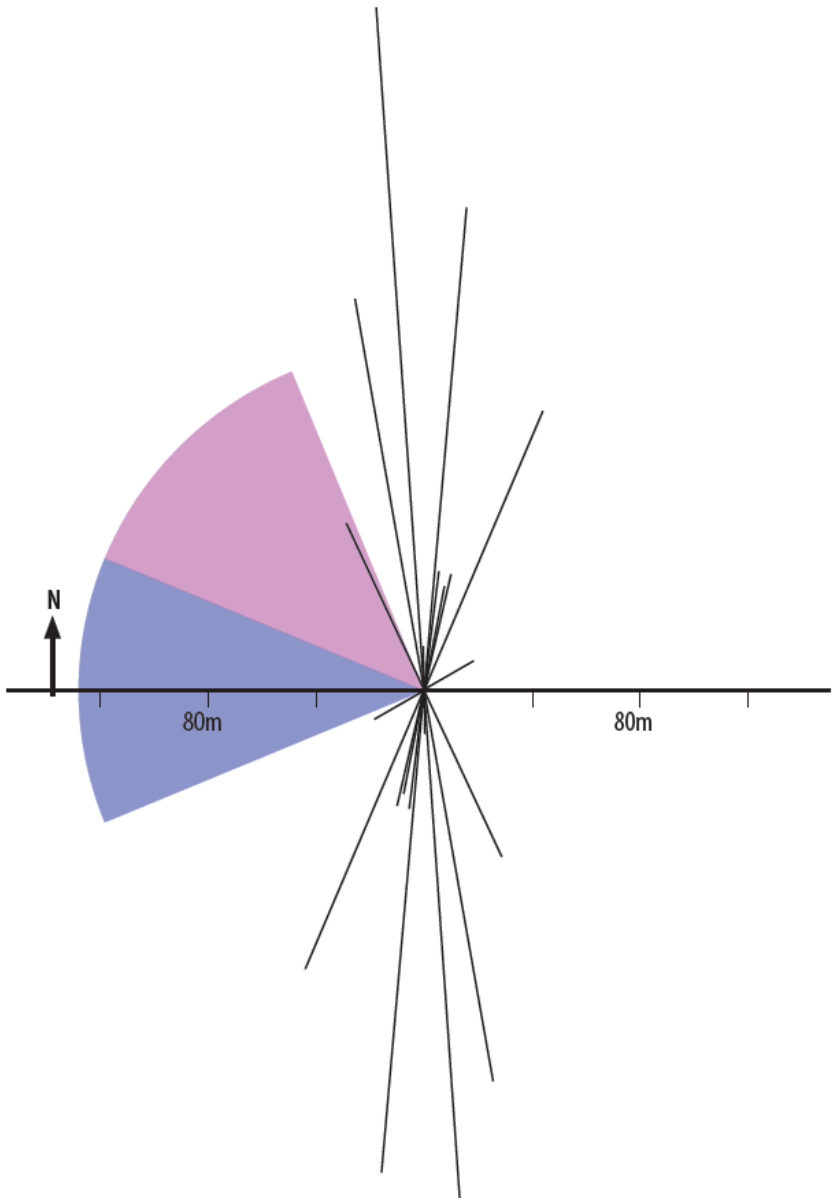


Stainforth
Total length (m) and bearing of system boundaries



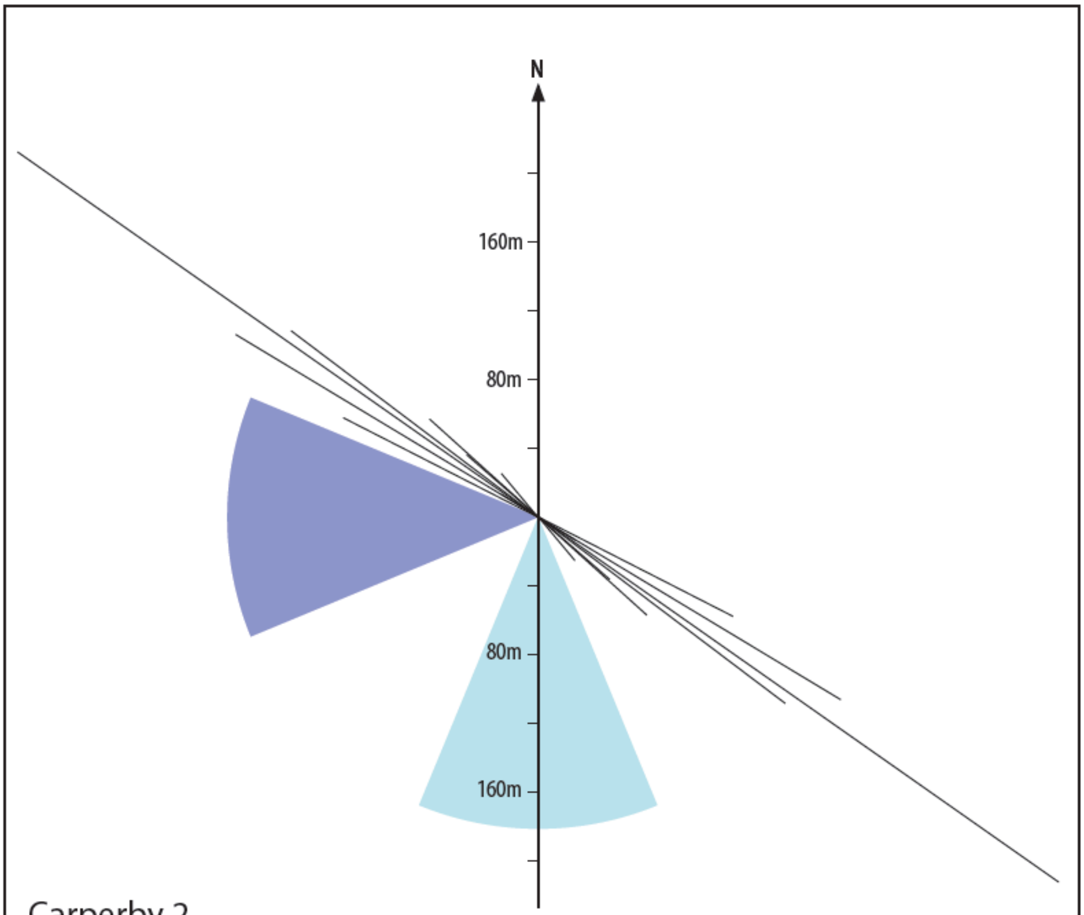
Settle

Total length (m) and bearing of system boundaries



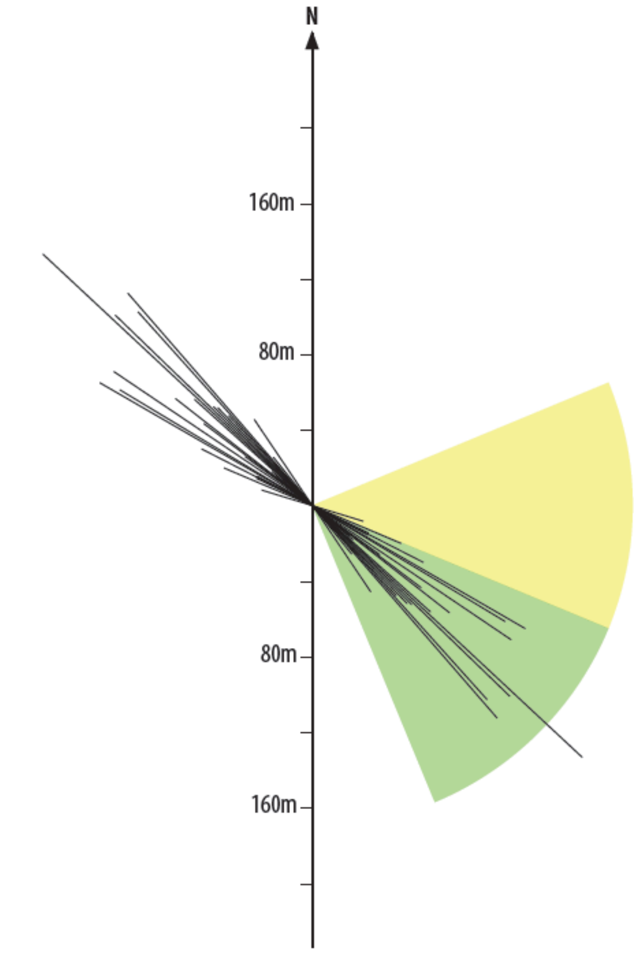
Carperby 1

Total length (m) and bearing of system boundaries

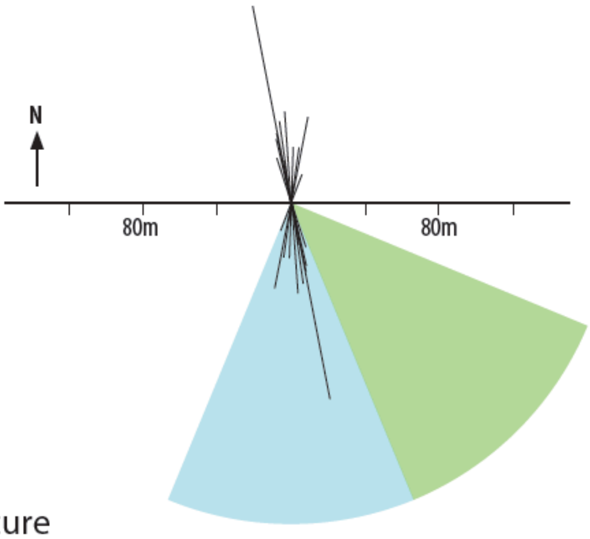


Carperby 2

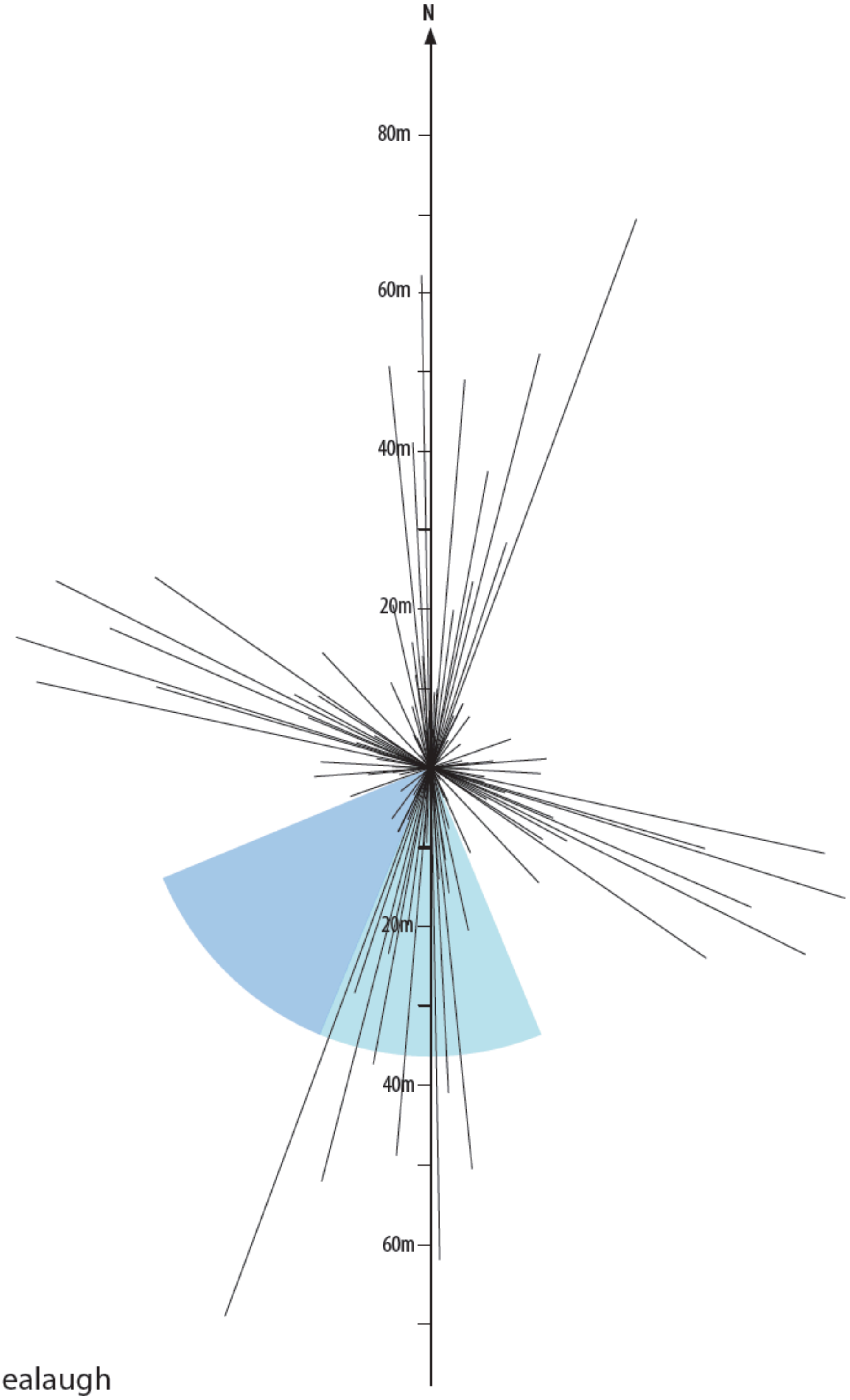
Total length (m) and bearing of system boundaries



West Burton
Total length (m) and bearing of system boundaries

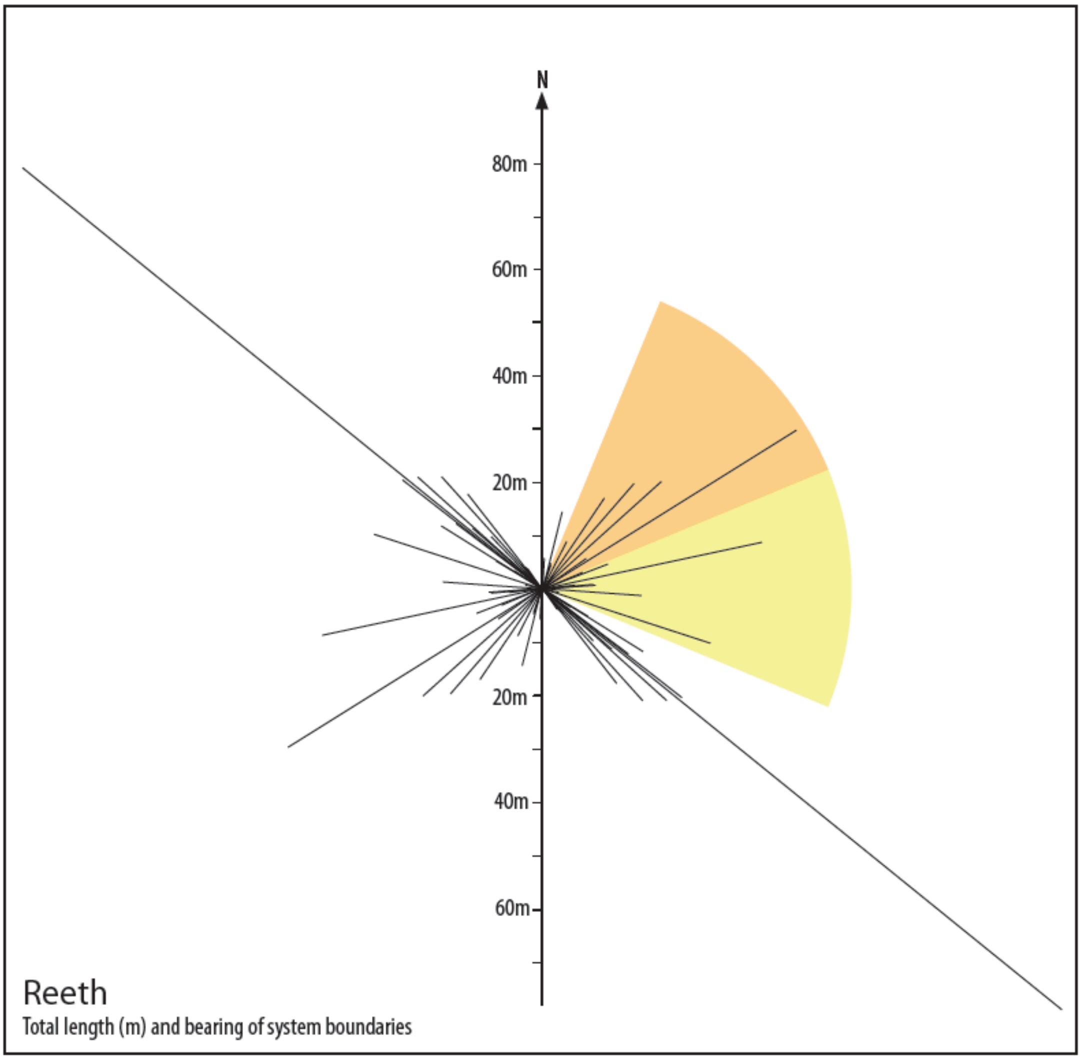


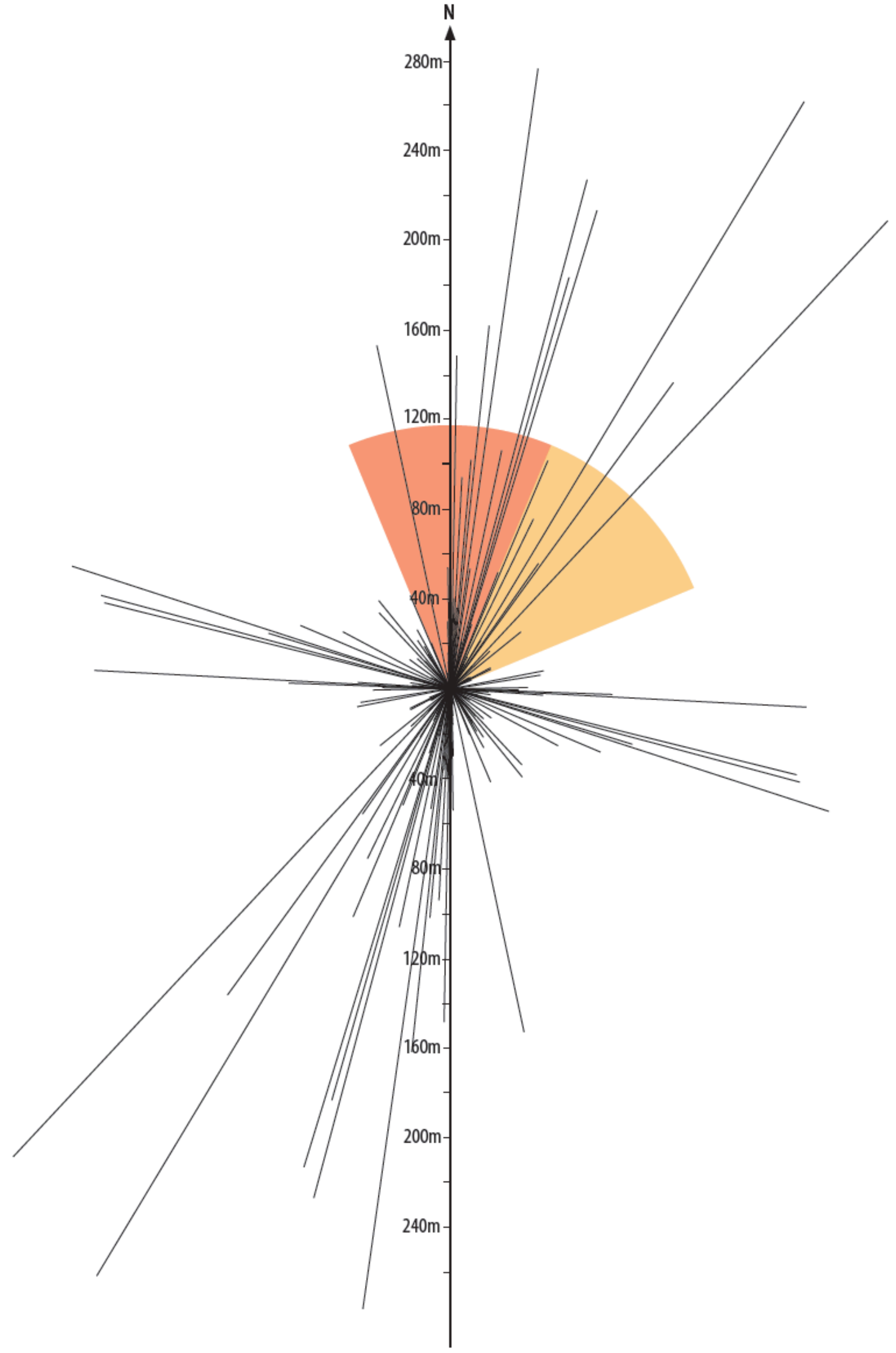
Low Row Pasture
Total length (m) and bearing of system boundaries



Healaugh

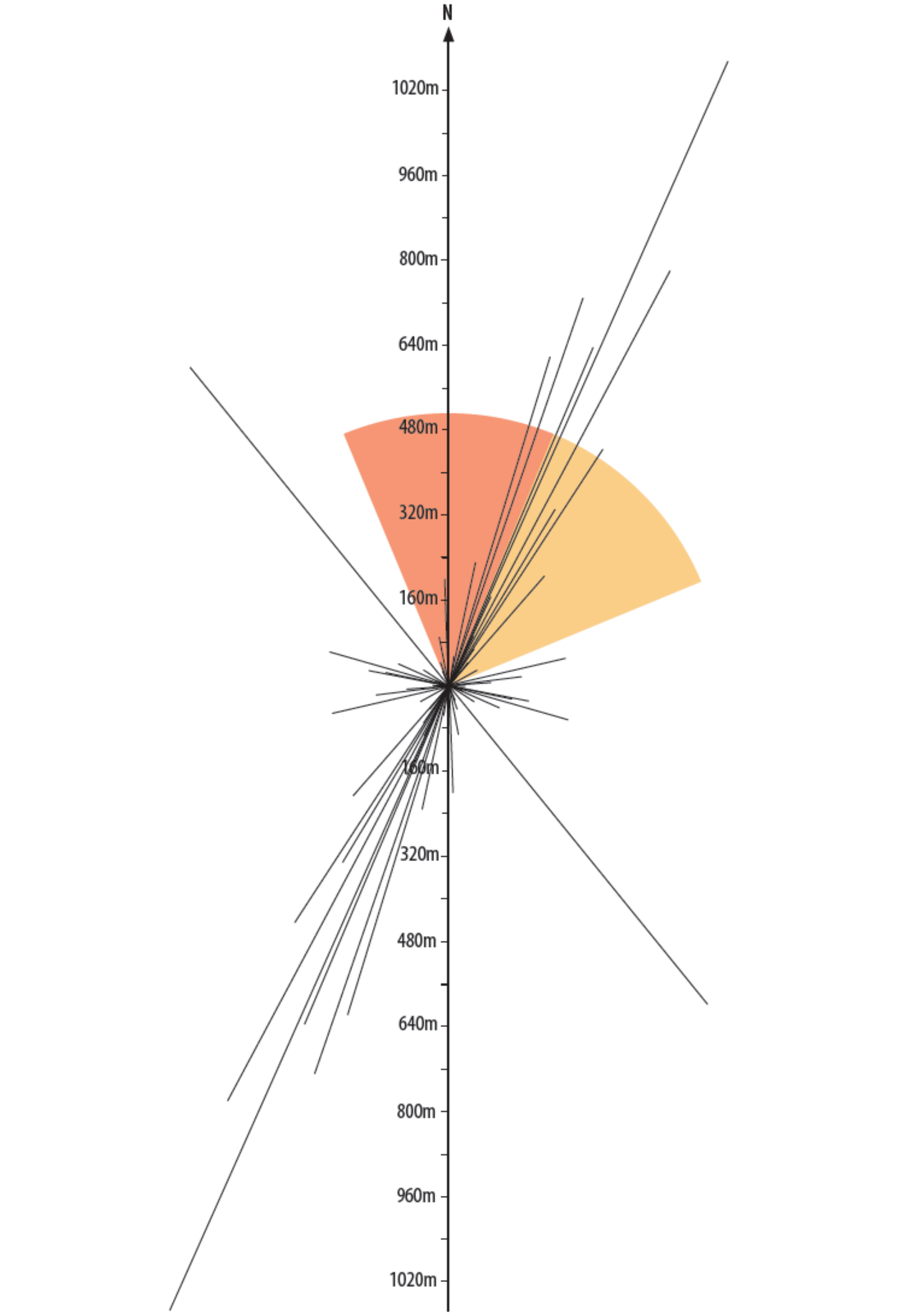
Total length (m) and bearing of system boundaries


N
80m
60m
40m
20m
20m
40m
60m
Reeth
Total length (m) and bearing of system boundaries



Harkerside

Total length (m) and bearing of system boundaries



Grinton
Total length (m) and bearing of system boundaries